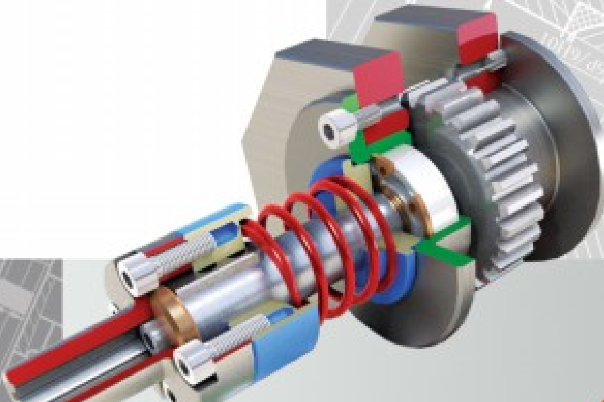
双色版

机械图样正误对比与解析200例

马慧　郭琳◎主编



一本书教你快速掌握

机械图样关键点！

扫二维码

看实例讲解微视频

机械工业出版社
CHINA MACHINE PRESS

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双色版

机械图样

正 误 对比与解析200例

主　编　马　慧　郭　琳
副主编　李运杰　孙曙光
参　编　金凤鸣　孟军红　冯　旭　刘　波

机械工业出版社
CHINA MACHINE PRESS

本书通过 200 多个典型实例，针对机械图样中的常见错误，采用正误对比的方式，分析其原因，并讲解正确的画法和绘图技巧。主要内容包括：机械图样基本知识、切割体与相贯体、组合体、机件的表达方法、轴测图、标准件与常用件、零件图、装配图、钣金展开图与焊接图。本书采用双色印刷，对重点、难点、易错点用红色表示；百个实例附有二维码，扫描后可观看实例讲解视频，便于读者理解。

本书可供从事机械设计、机械制造的工程技术人员和技术工人使用，也可供大中专工科院校的师生参考。

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前　言

机械图样由图形、符号和文字组成，是工程技术人员进行信息传递和交流技术思想的重要工具，是制造行业的工人必须掌握的基本知识。因为图样中包含的内容较多，涉及面很广，所以初学者在学习和工作中，对图样的表达可能会出现一些不正确或不合理之处。本书正是基于帮助初学者明辨正误，加深理解，提高空间想象力和增强贯彻制图新标准的意识而编写的。

本书具有如下特点：

1. 每个图例均以正误对比的方式给出，详细解析在绘图过程中常犯的错误和正确的表达方式。读者可先自行分析不正确的图例并找出错误，再与正确的图例对比，可提高识读能力。

2. 本书采用双色印刷，对图中不正确之处用红色表示，用指引线将提示性文字标注在图上，方便读者了解图样的易错点。

3. 本书图样选自生产实践和制图标准中的典型实例，有较强的实用性和代表性。

4. 本书采用机械制图新标准，同时给出了新旧标准的异同对比，便于读者理解和贯彻新标准。

5. 本书采用特殊版式设计，每个实例的内容控制在单独的一面或打开的两面内，可免去翻页对照看图的不便，在一定程度上提高了阅读体验感。

6. 书中附有百幅二维码，扫描后可观看相应实例的讲解视频，丰富了本书的内容。建议在 Wi-Fi 环境下观看。

书中图样下的符号含义是：正表示正确或合理的图样，误表示错误或不合理的图样。

本书由马慧和郭琳主编，具体编写分工如下：第 1 章、第 3 章、第 5 章由马慧编写；第 2 章由郭琳编写；第 6 章由李运杰编写；第 4 章由孙曙光编写；第 7 章由金凤鸣编写；第 8 章由孟军红编写；第 9 章由冯旭和刘波编写，其中焊接图部分由冯旭编写，钣金展开图部分由刘波编写。

由于时间紧张、水平有限，书中难免存在不妥之处，敬请广大读者批评指正。

编　者

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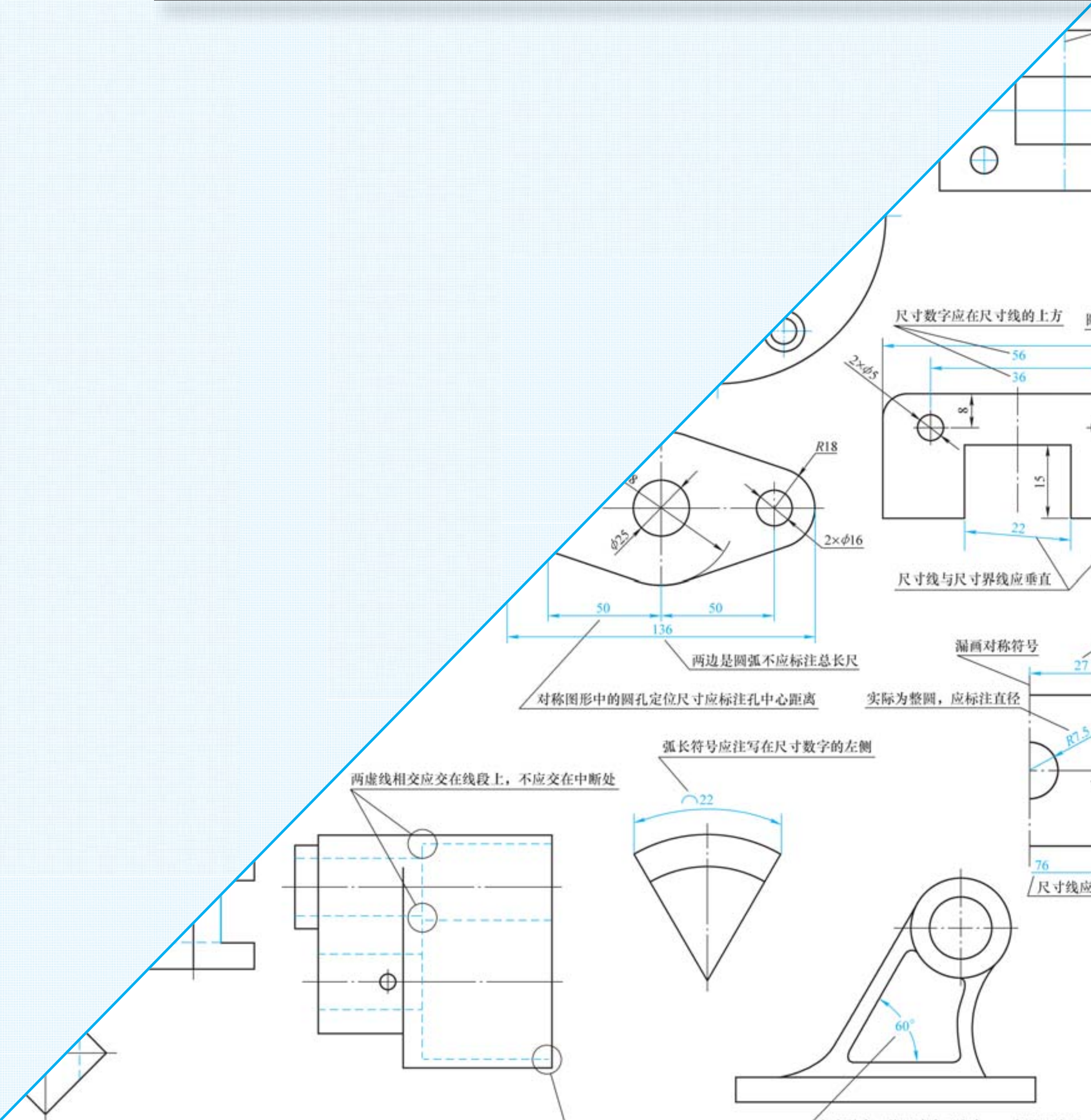
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第 1 章 机械图样基本知识

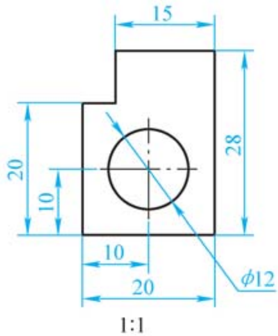


1.1　比例

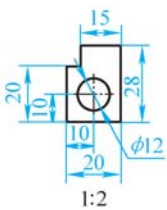
例 1-1　分析用不同比例绘制图形尺寸标注的正误



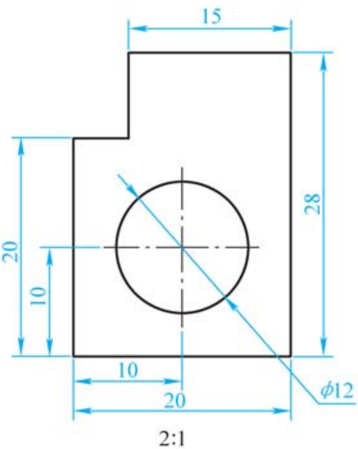
a) 立体图



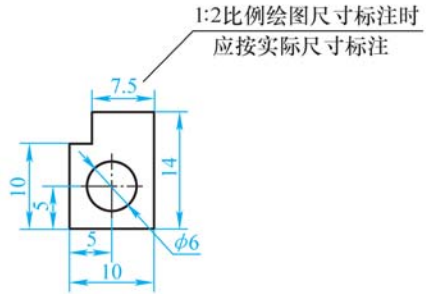
b) 正



c) 正

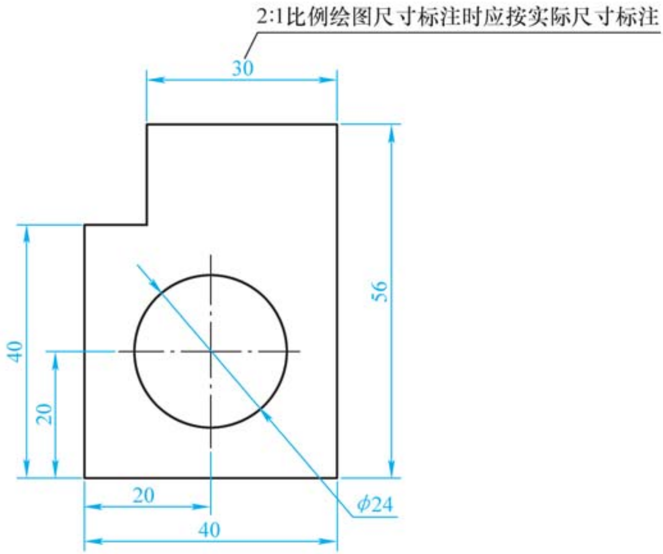


d) 正



扫码看视频讲解

e) 误



f) 误

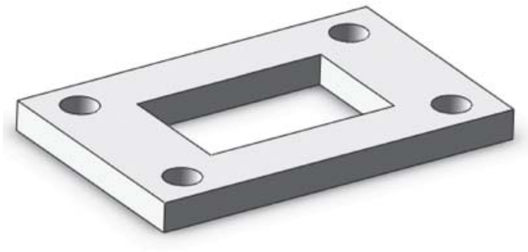
说明

图样上标注的尺寸数值就是工件实际大小的数值，它与绘图时采用的绘图比例无关。

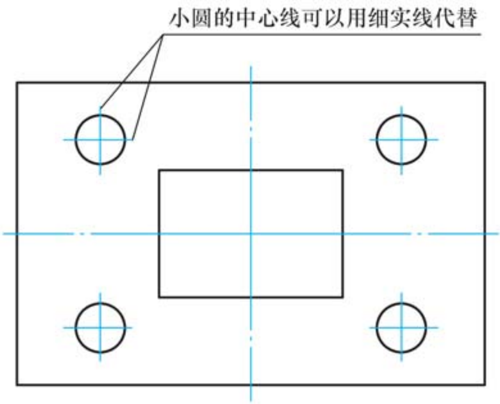
1.2　图线的画法

1.2.1　细点画线

例 1-2　分析图中对称中心线的正误

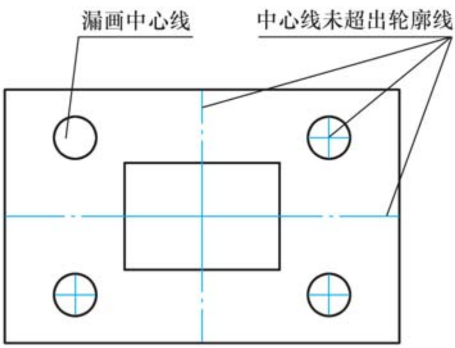


a) 立体图

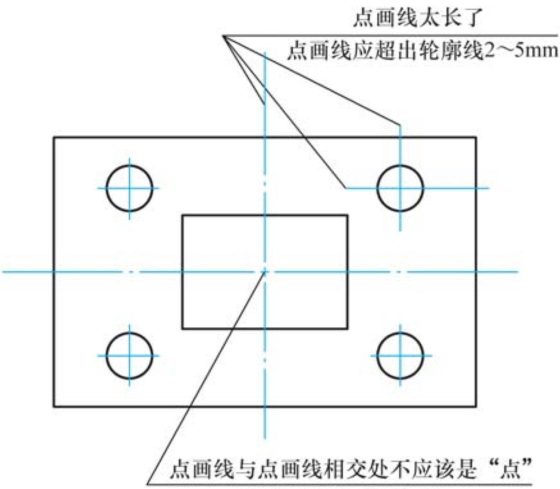


b) 正

扫码看视频讲解



c) 误

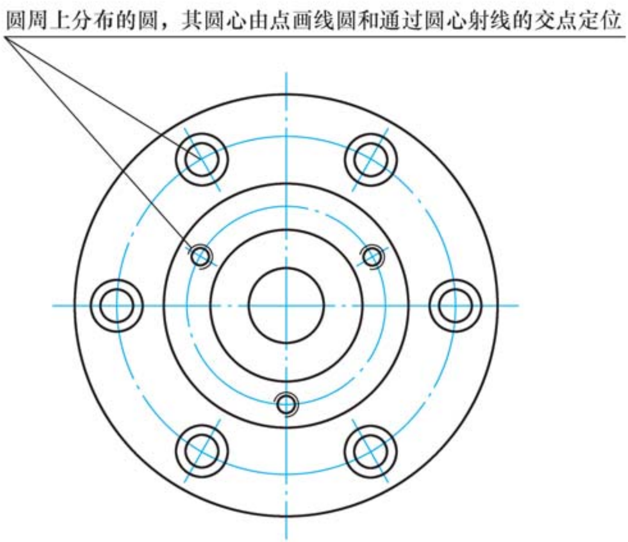


d) 误

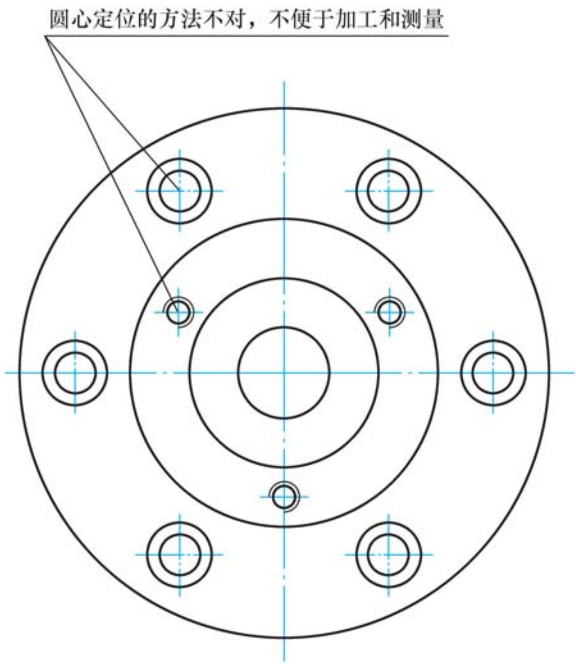
例 1-3　分析圆周上分布圆的中心线正误



a) 立体图



b) 正



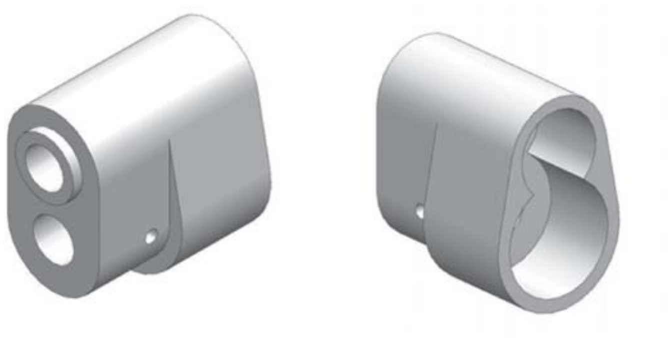
c) 误

说明

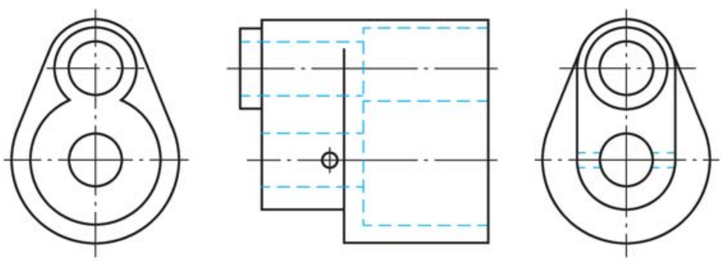
在同一个圆周上均匀分布的圆，只需要标注点画线圆的直径尺寸即可以确定圆心的位置，而且不需要标注角度尺寸。

1.2.2 细虚线

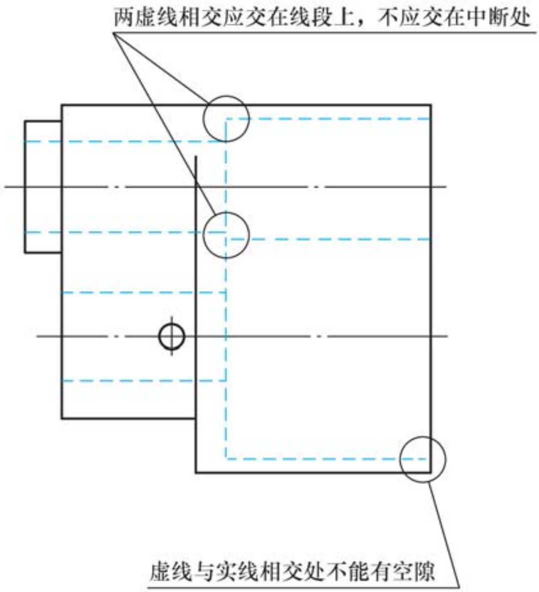
例 1-4 分析图中细虚线画法的正误



a) 立体图



b) 正



c) 误

说明

虚线画法应注意以下问题：

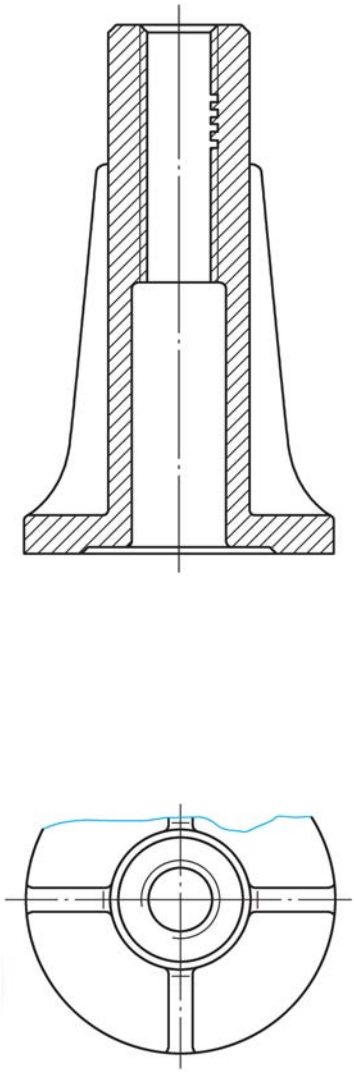
1. 虚线与虚线相交，应交在线段上。
2. 虚线与点画线相交，应交在线段上。
3. 虚线与粗实线相交，不应留空隙。

1.2.3 波浪线

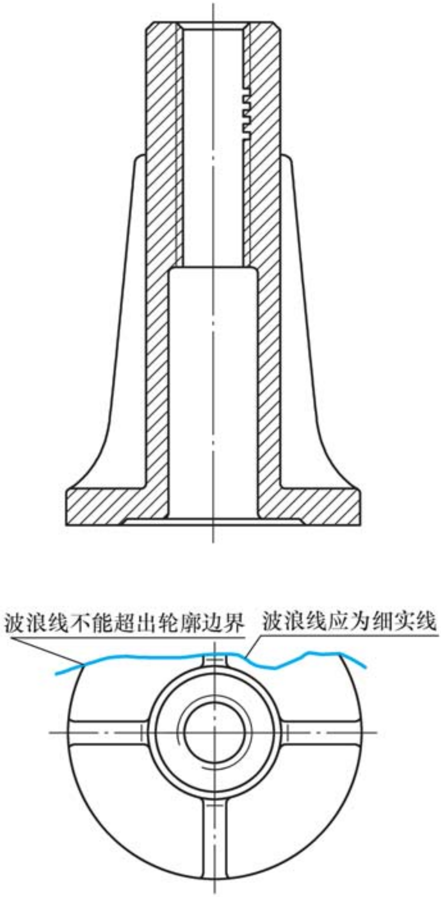
例 1-5　分析底座俯视图中波浪线画法的正误



a) 立体图



b) 正



c) 误

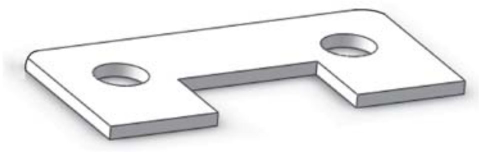
说明

1. 波浪线表示断裂处的边界和视图与剖视图的分界，因此波浪线不应超出断裂处的边界。

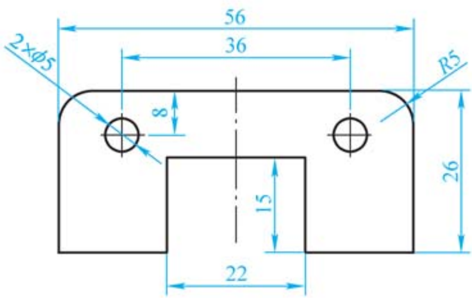
2. 波浪线用细实线表示。

1.3 尺寸标注基本知识

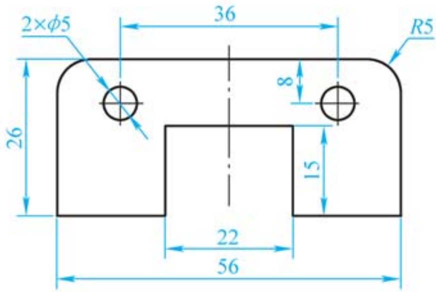
例 1-6 分析图中垫片的尺寸标注的正误



a) 立体图

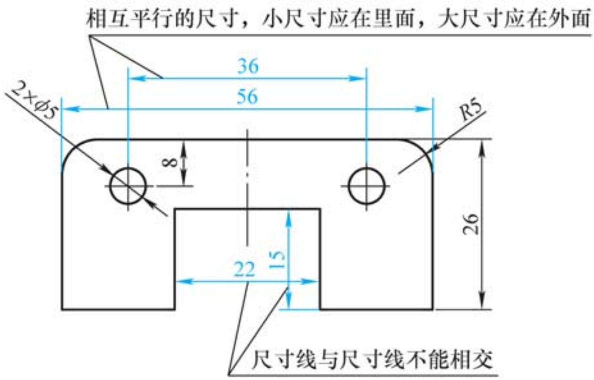


b) 正

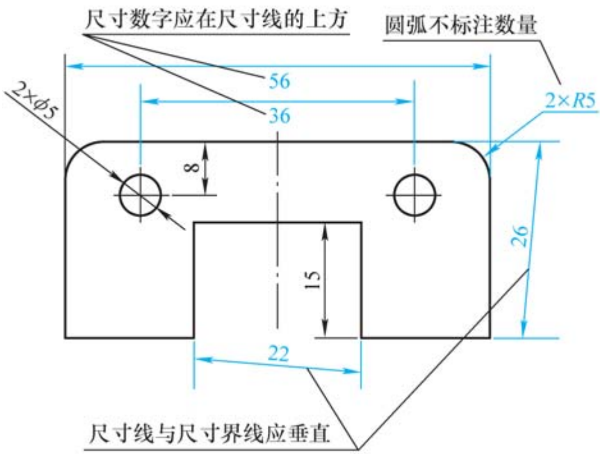


c) 正

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d) 误



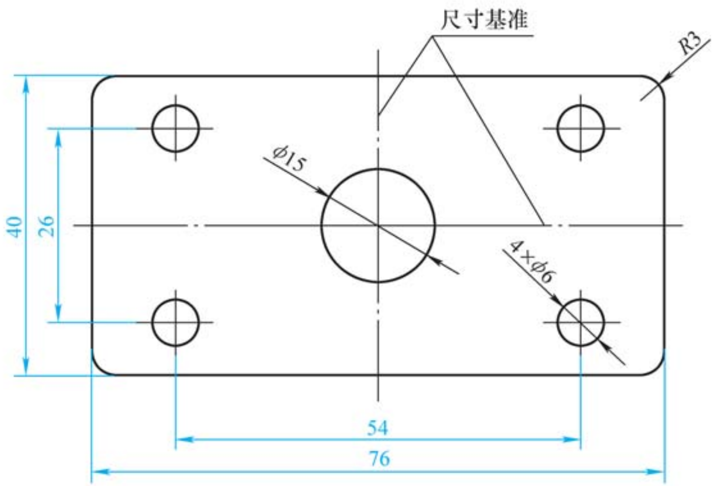
e) 误

例 1-7　分析对称零件尺寸标注的正误

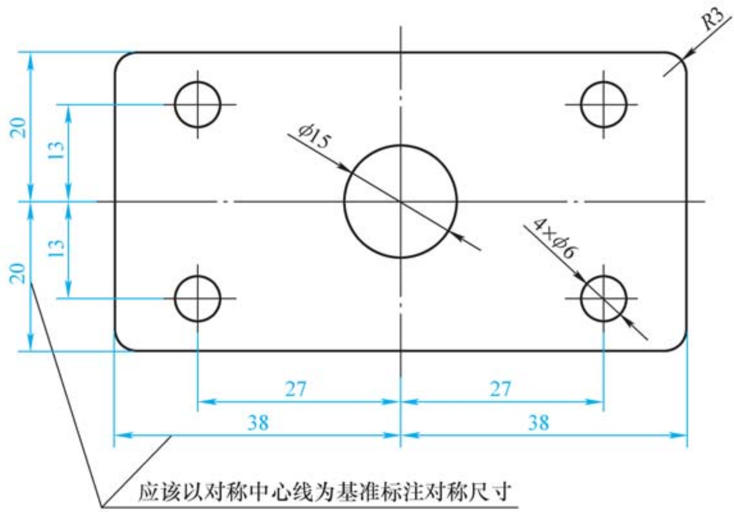
扫码看视频讲解



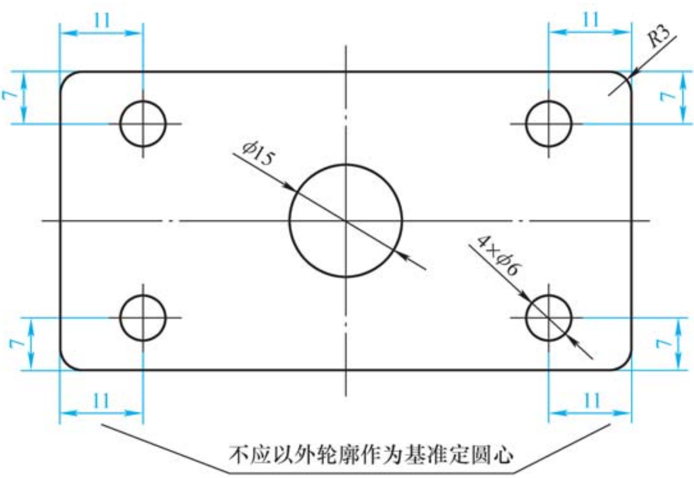
a) 立体图



b) 正


R3
ϕ15
4×ϕ6
20
13
13
20
27
27
38
38
应该以对称中心线为基准标注对称尺寸

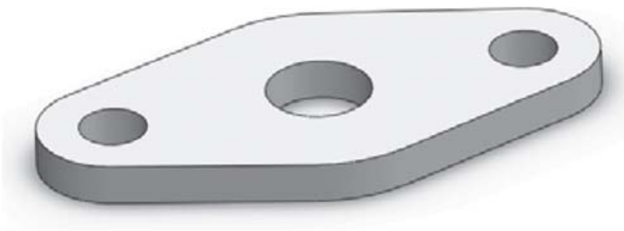
c) 误


11
11
R3
7
7
ϕ15
4×ϕ6
7
7
11
11
不应以外轮廓作为基准定圆心

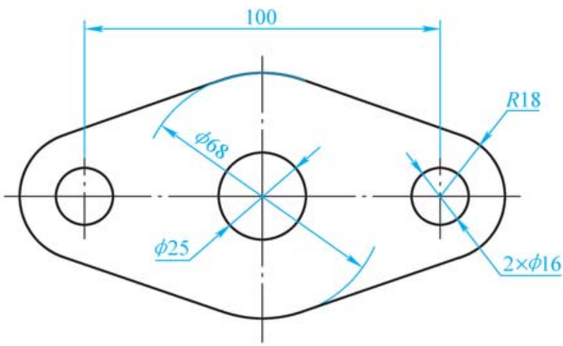
d) 误

例 1-8　分析对称零件尺寸标注的正误

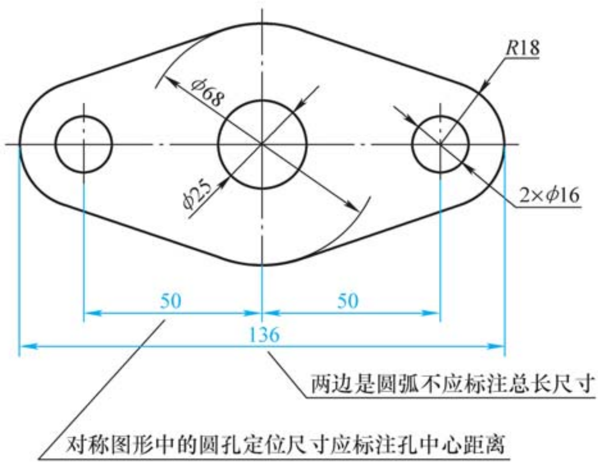
扫码看视频讲解



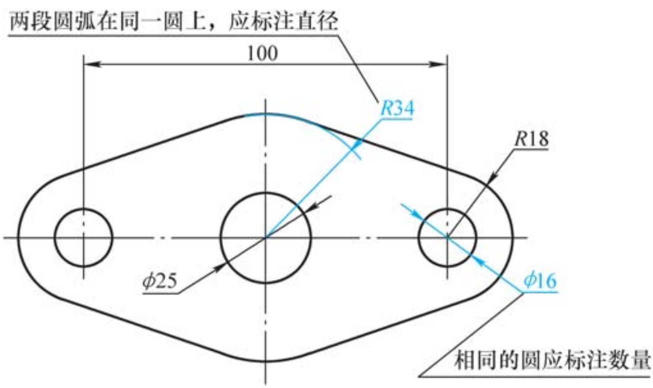
a) 立体图



b) 正

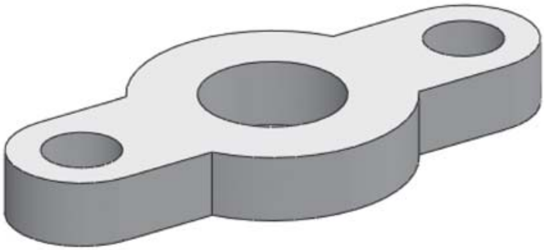

R18
ϕ68
ϕ25
2×ϕ16
50
50
136
两边是圆弧不应标注总长尺寸
对称图形中的圆孔定位尺寸应标注孔中心距离

c) 误

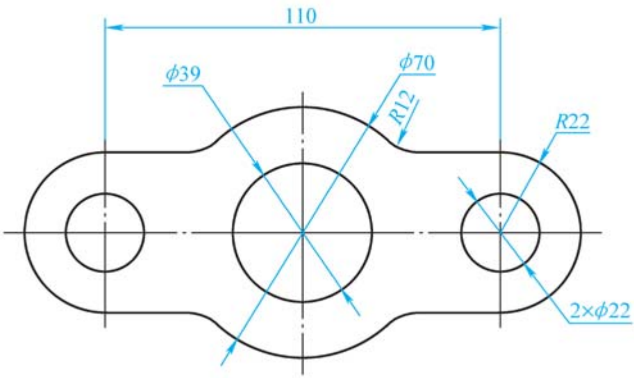

两段圆弧在同一圆上，应标注直径
100
R34
R18
ϕ25
ϕ16
相同的圆应标注数量

d) 误

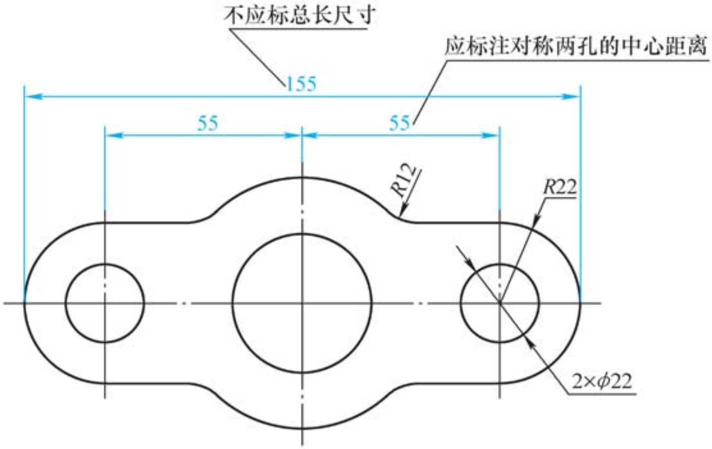
例 1-9　分析对称零件尺寸标注的正误



a) 立体图

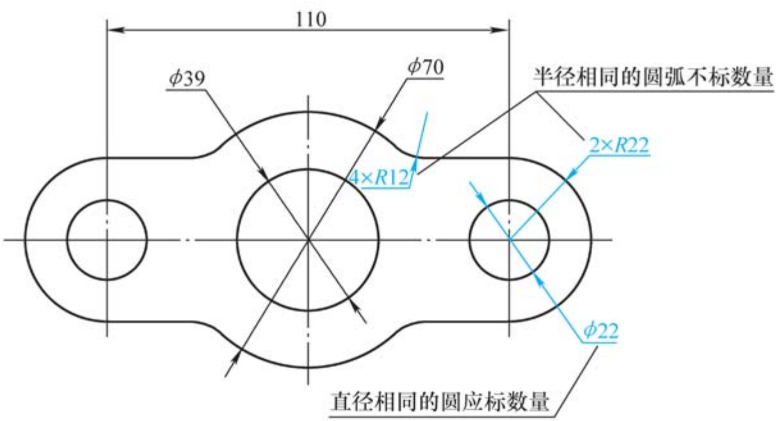


b) 正



不应标总长尺寸
应标注对称两孔的中心距离
155
55
55
R12
R22
2×ϕ22

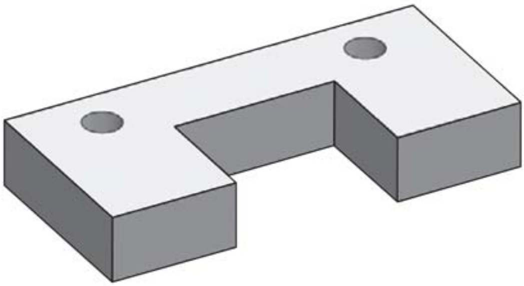
c) 误



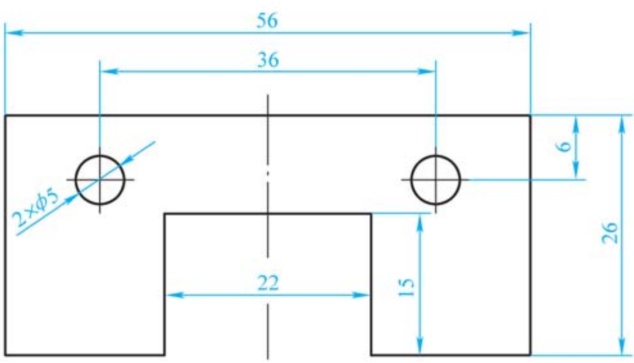
110
ϕ39
ϕ70
半径相同的圆弧不标数量
2×R22
4×R12
ϕ22
直径相同的圆应标数量

d) 误

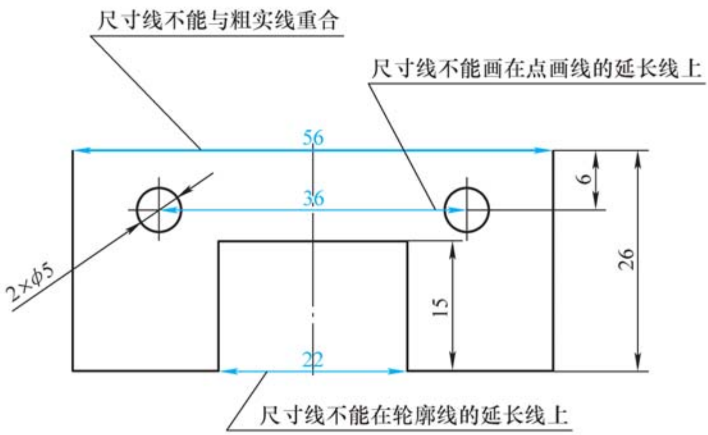
例 1-10　分析零件尺寸标注的正误



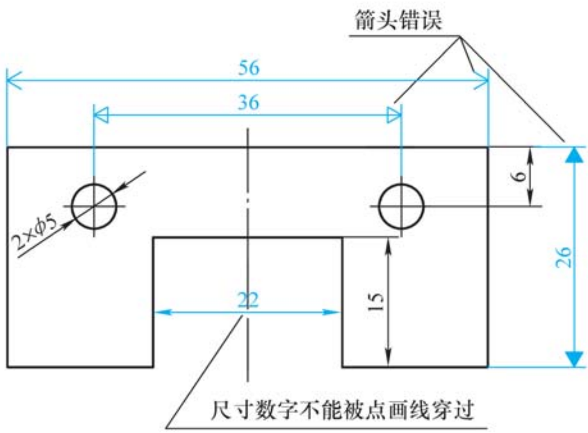
a) 立体图



b) 正

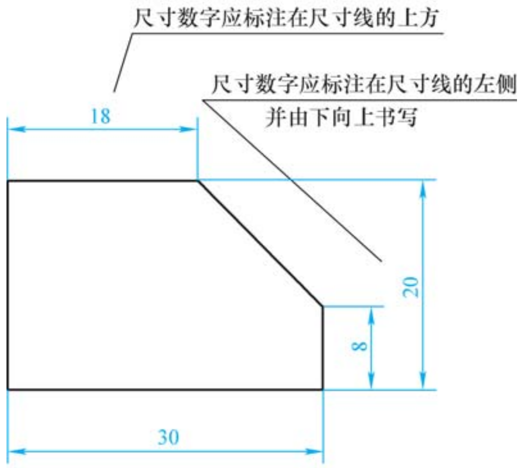

尺寸线不能与粗实线重合
尺寸线不能画在点画线的延长线上
56
36
6
26
2×ϕ5
15
22
尺寸线不能在轮廓线的延长线上

c) ㊔

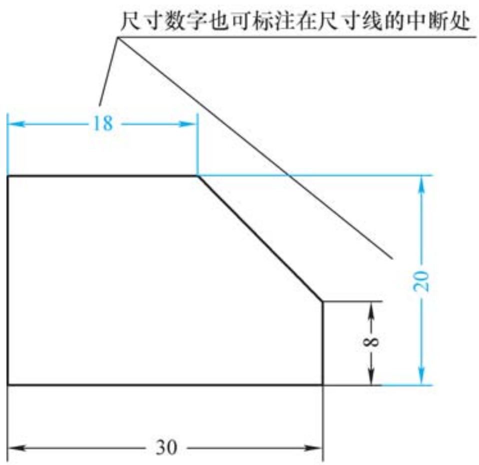

箭头错误
56
36
6
2×ϕ5
26
22
15
尺寸数字不能被点画线穿过

d) ㊔

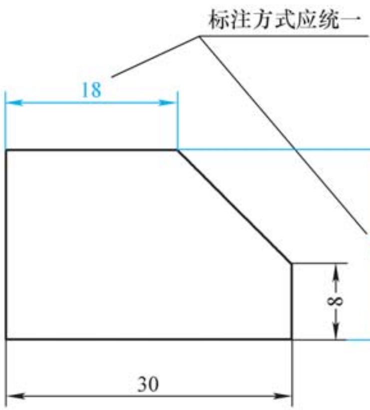
例 1-11　分析尺寸标注的正误



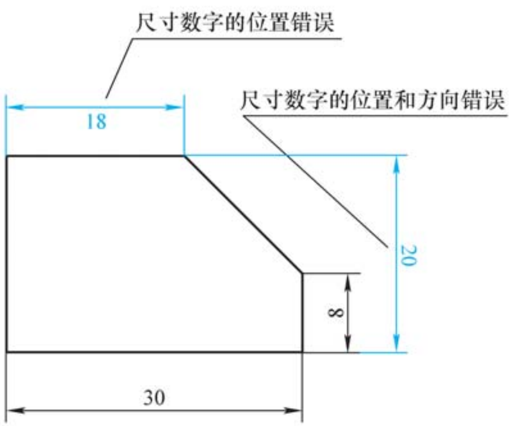
a) 正



b) 正



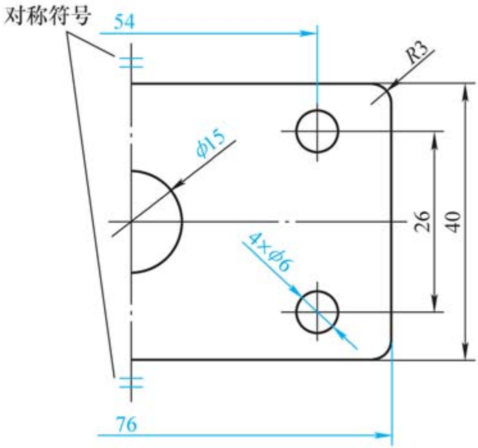
c) 误



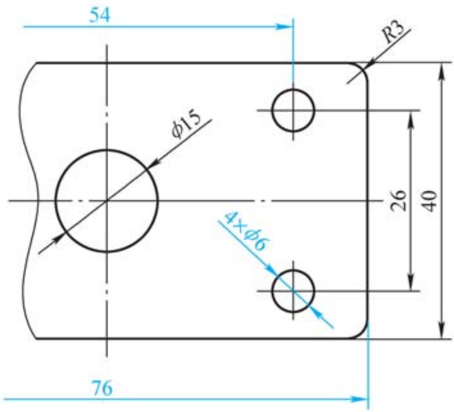
d) 误

例 1-12　分析对称尺寸标注的正误

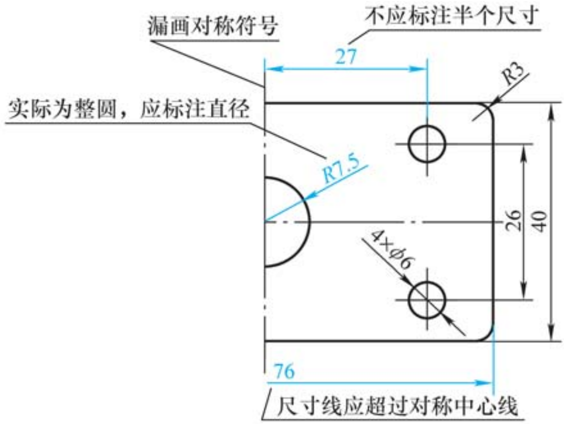




a) 正

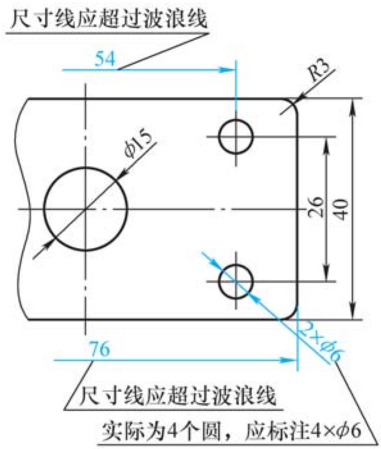


b) 正



漏画对称符号
不应标注半个尺寸
27
R3
实际为整圆，应标注直径
R7.5
26
40
4×ϕ6
76
尺寸线应超过对称中心线

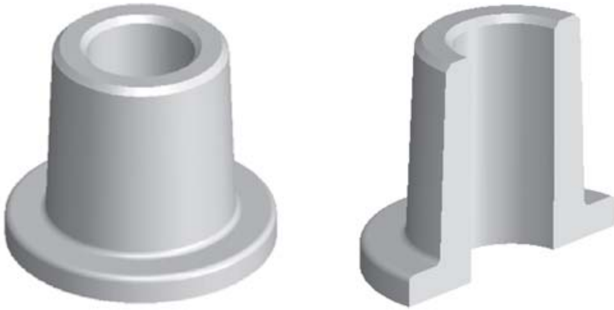
c) 误



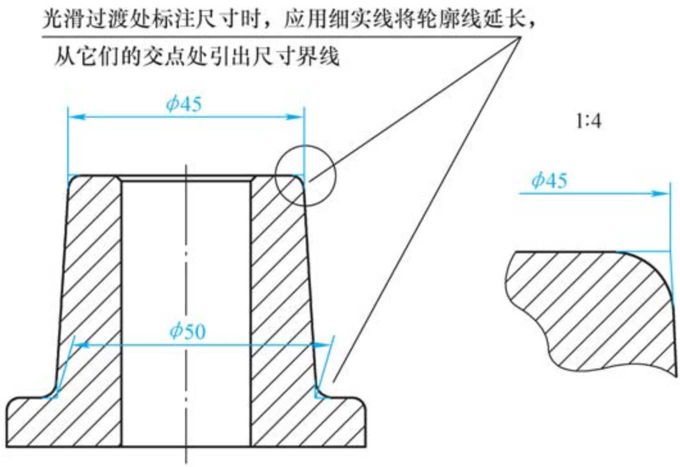
尺寸线应超过波浪线
54
R3
ϕ15
26
40
2×ϕ6
76
尺寸线应超过波浪线
实际为4个圆，应标注4×ϕ6

d) 误

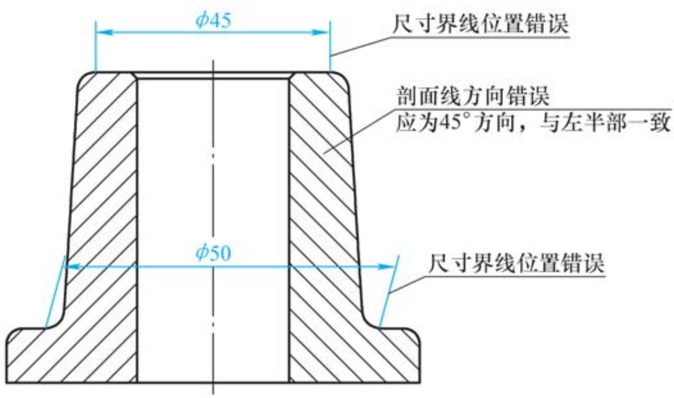
例 1-13　分析图中尺寸标注的正误



a) 立体图

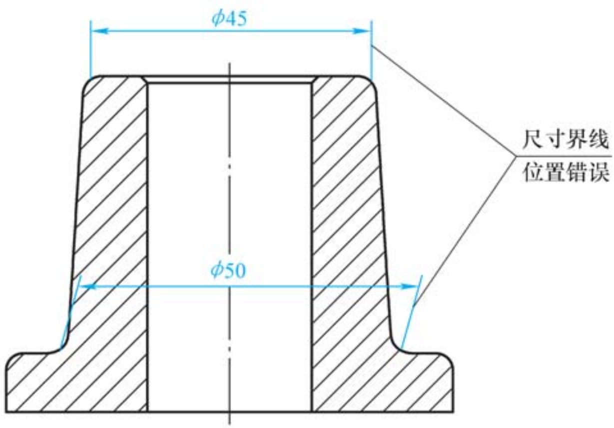


b) 正



ϕ45
尺寸界线位置错误
剖面线方向错误
应为45°方向，与左半部一致
ϕ50
尺寸界线位置错误

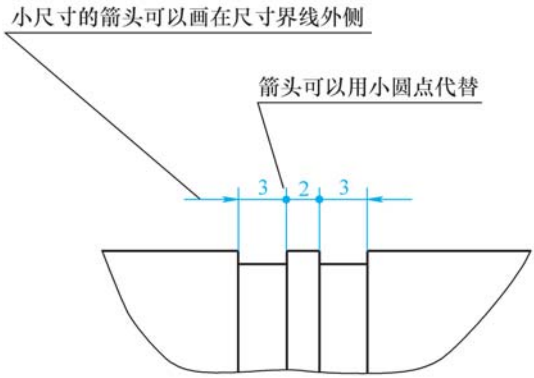
c) 误



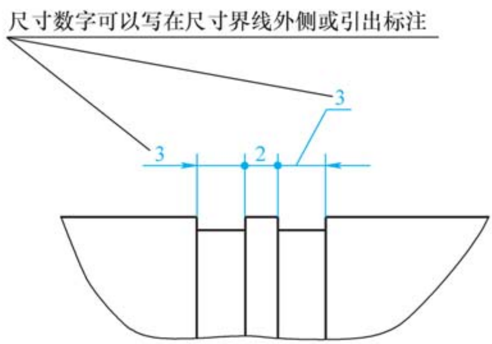
ϕ45
尺寸界线
位置错误
ϕ50

d) 误

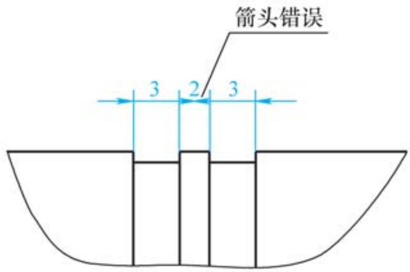
例 1-14　分析图中小尺寸标注的正误



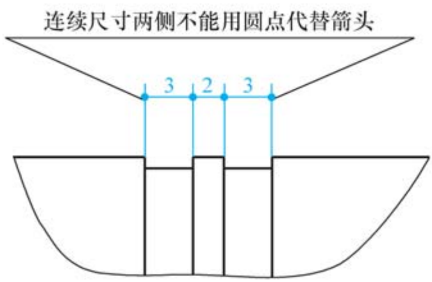
a) 正



b) 正



c) 误

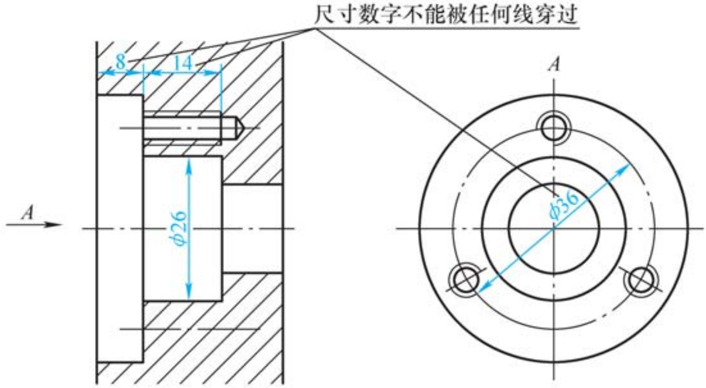


d) 误

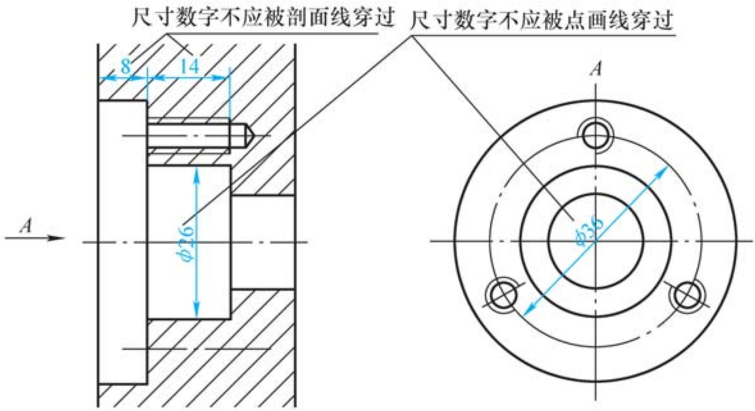
说明

对于线性小尺寸，没有足够的位置画箭头时，箭头可以由尺寸界线外指向内，连续尺寸间隔可以用实心圆点或斜线代替箭头。

例 1-15　分析图中尺寸标注的正误



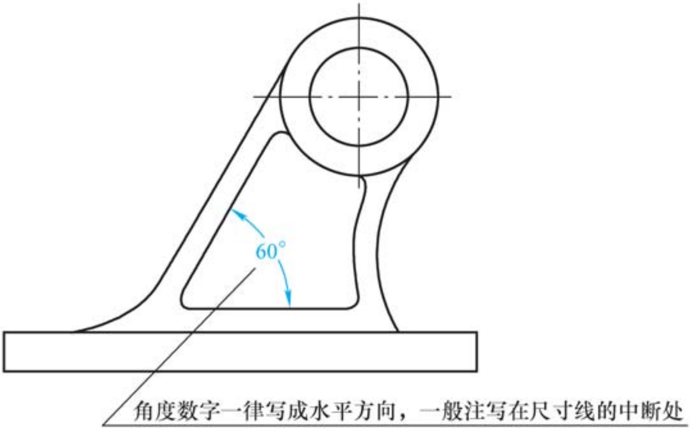
a) 正



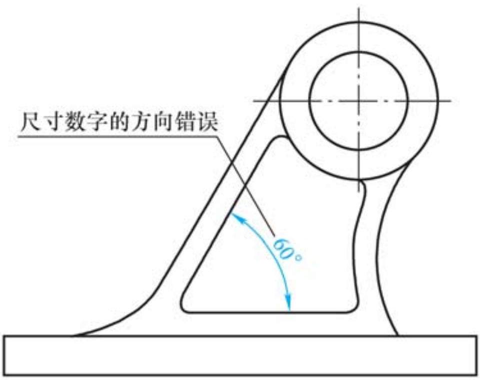
b) 误

扫码看视频讲解

例 1-16　分析图中角度尺寸标注的正误

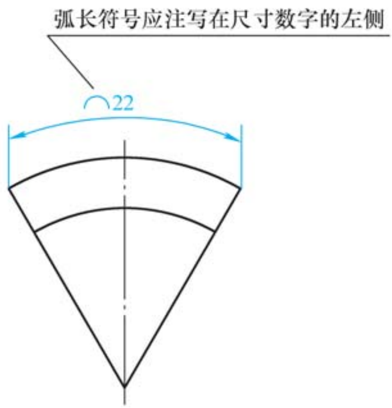


a) 正

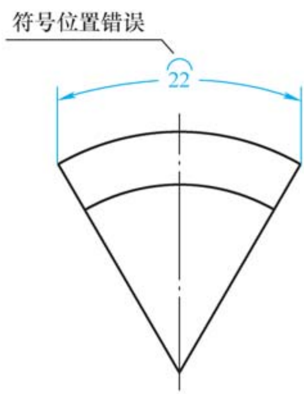


b) 误

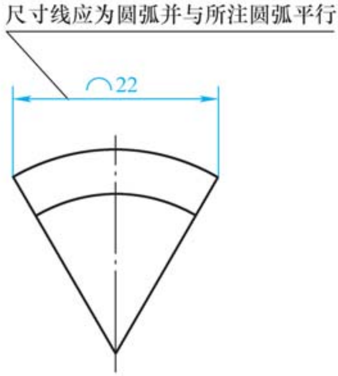
例 1-17　分析图中弧长尺寸标注的正误



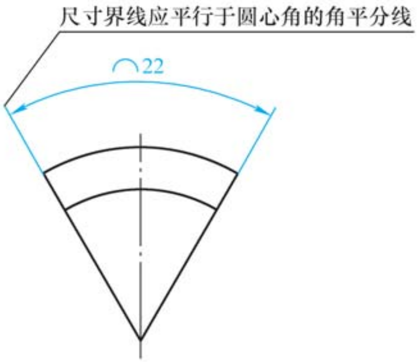
a) 正



b) 误



c) 误



d) 误

扫码看视频讲解

说明

1. 表示弧长时，尺寸线与所表示的弧平行，尺寸界线平行于弧所对圆心角的角平分线。

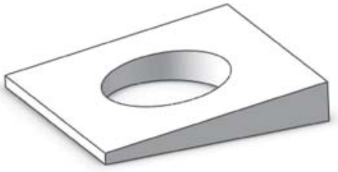
2. 弧长符号应并排书写在数字前面。

1.4 斜度和锥度

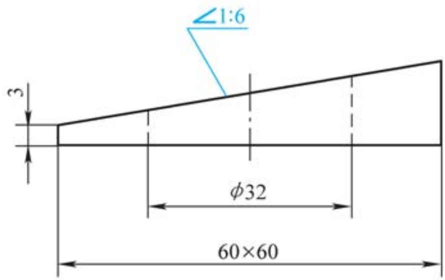
1.4.1 斜度

例 1-18 分析图中斜度标注的正误

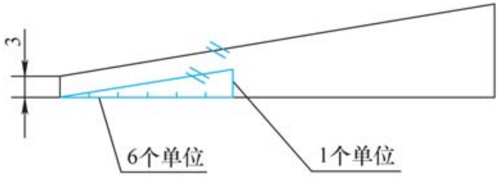
扫码看视频讲解



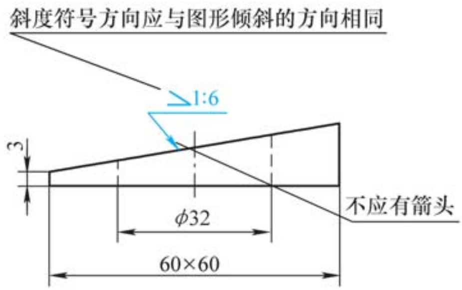
a) 立体图



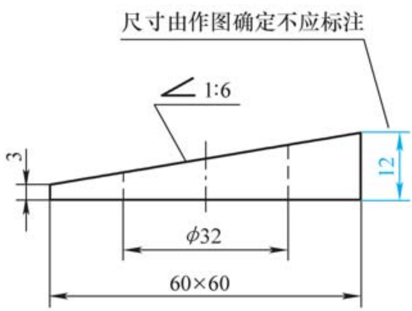
b) 正



c) 斜度画法



d) 误



e) 误

说明

1. 斜度是指一条直线相对另一条直线或一个平面相对另一个平面的倾斜程度。

2. 在图样中，斜度用 1 : n 的形式表示其大小。

3. 斜度符号的斜线方向应与图形中的倾斜方向相同，并且符号的水平线和斜线应和所标斜度的方向对应。

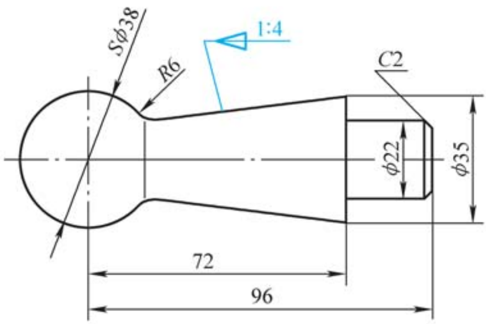
1.4.2 锥度

例 1-19 分析图中锥度标注的正误

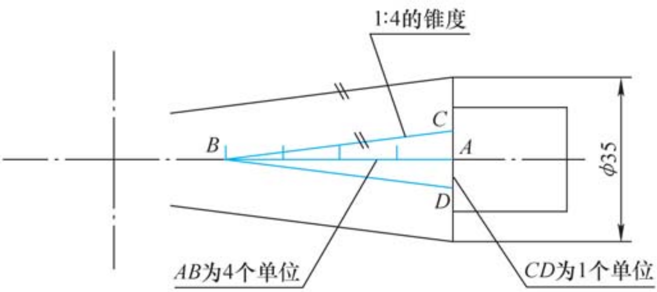
扫码看视频讲解



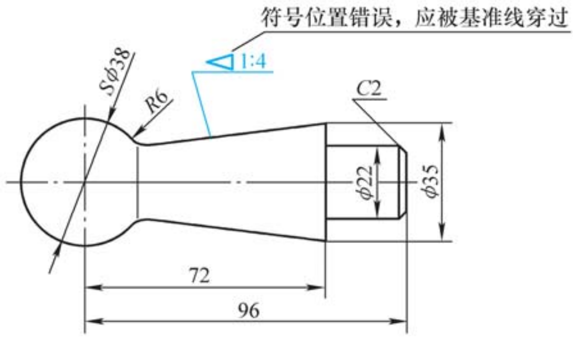
a) 立体图



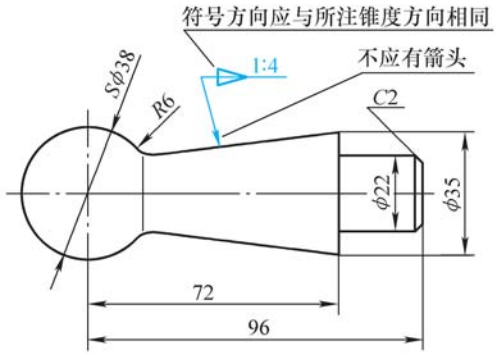
b) 正



c) 锥度画法



d) 误



e) 误

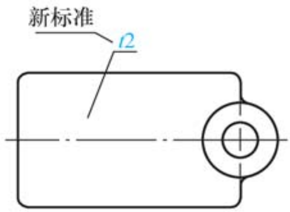
说明

1. 锥度是指圆锥底面与其高度的比值。
2. 在图样中，锥度用 1 ∶ n 的形式表示其大小。
3. 锥度符号的斜线方向应与图样上的锥度方向一致。

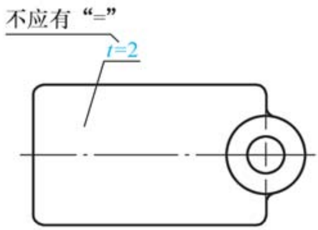
1.5　其他标注方法

例 1-20　分析厚度尺寸标注方法的正误

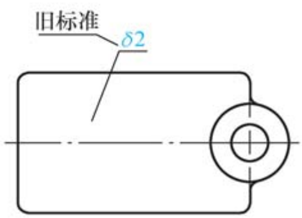
扫码看视频讲解



a) 正

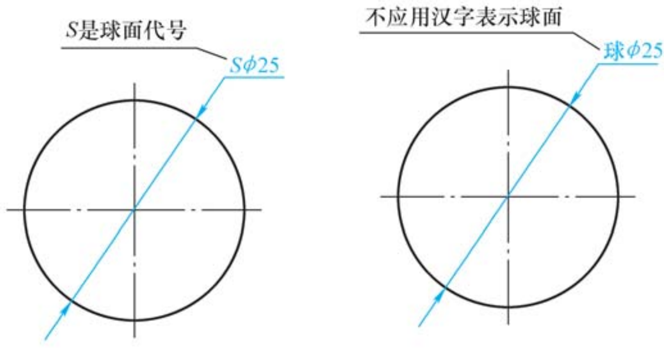


b) 误



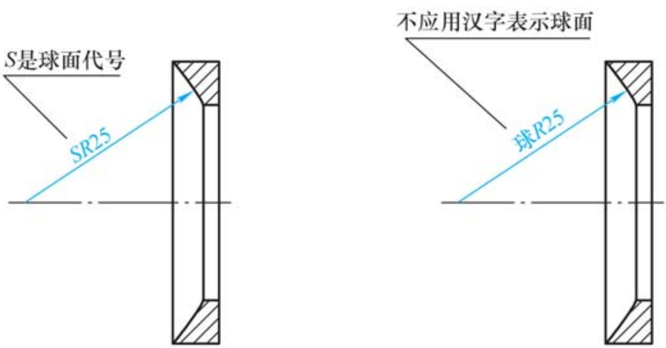
c) 误

例 1-21　分析球面尺寸标注方法的正误



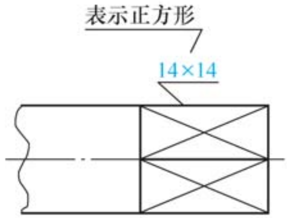
a) 正　　b) 误

例 1-22　分析球面尺寸标注方法的正误

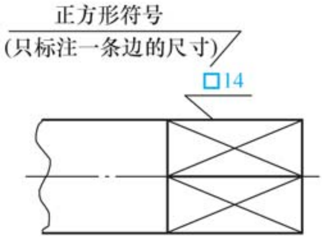


a) 正　　b) 误

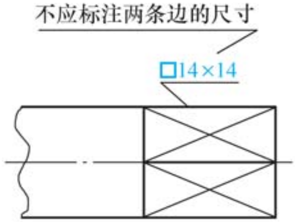
例 1-23　分析正方形标注方法的正误



a) 正

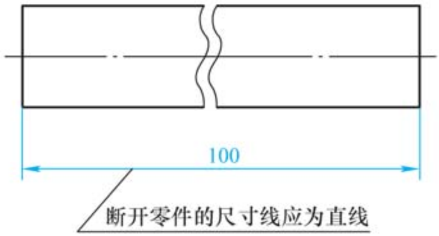


b) 正

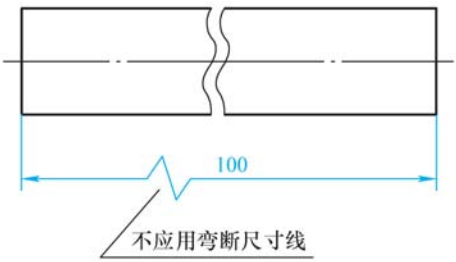


c) 误

例 1-24　分析断开零件尺寸标注方法的正误



a) 正



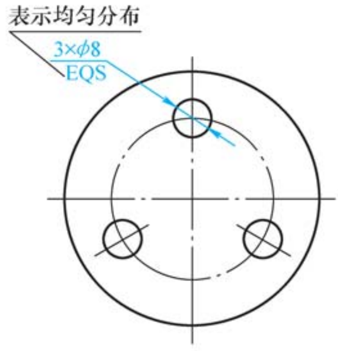
b) 误

说明

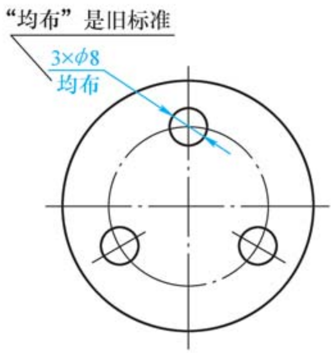
1. 对于较长的杆类零件，为了减小图纸幅面，一般用波浪线断开表示。

2. 在图样中，断开的图形尺寸线和尺寸数值应按原图形的标注方法标注。

例 1-25　分析圆周上均匀分布的圆尺寸标注方法的正误



a) 正

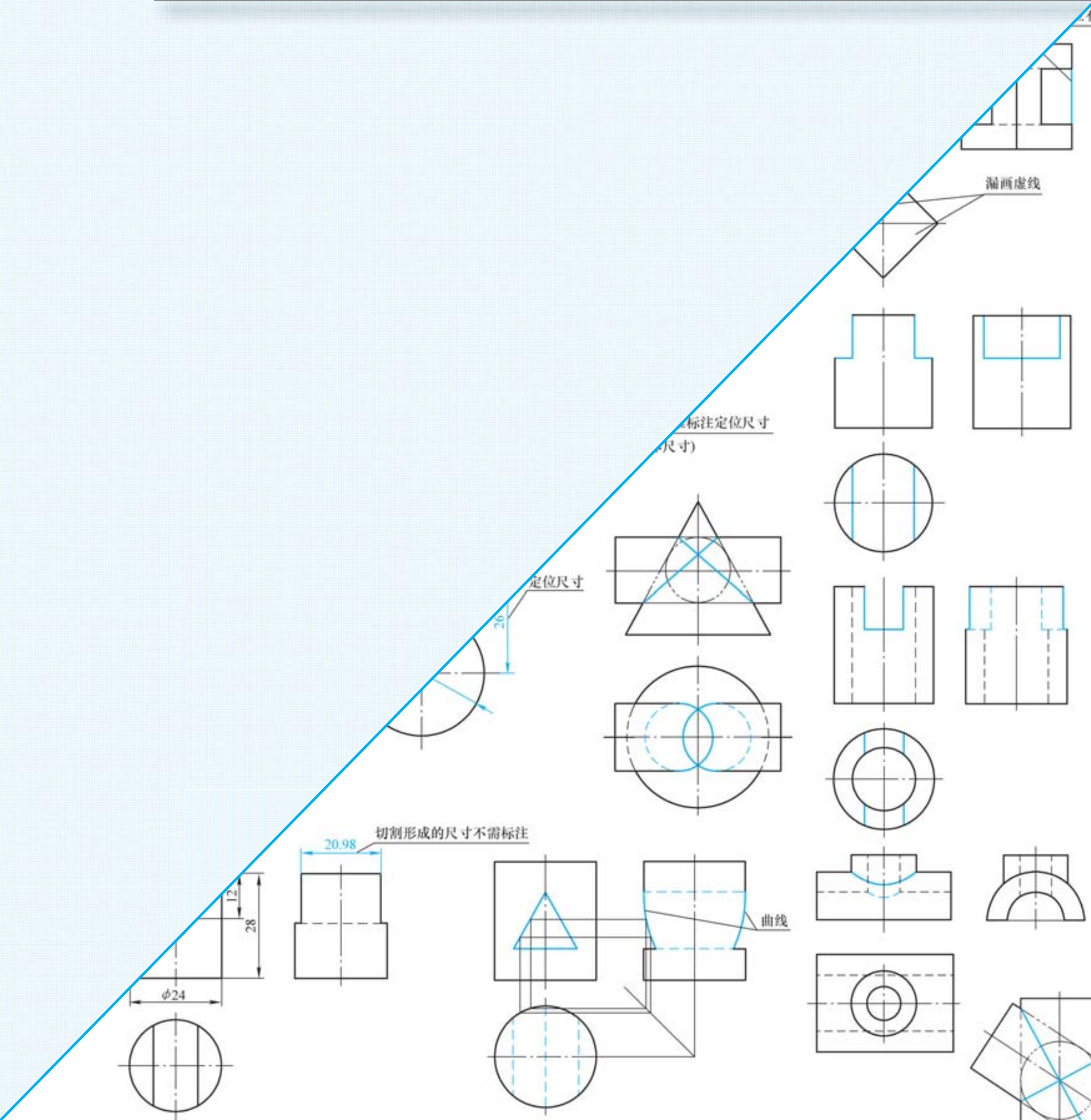


b) 误

说明

“EQS”是“Equally Spaced”的缩写，表示均匀分布。

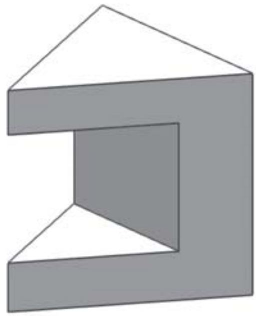
第 2 章 切割体与相贯体



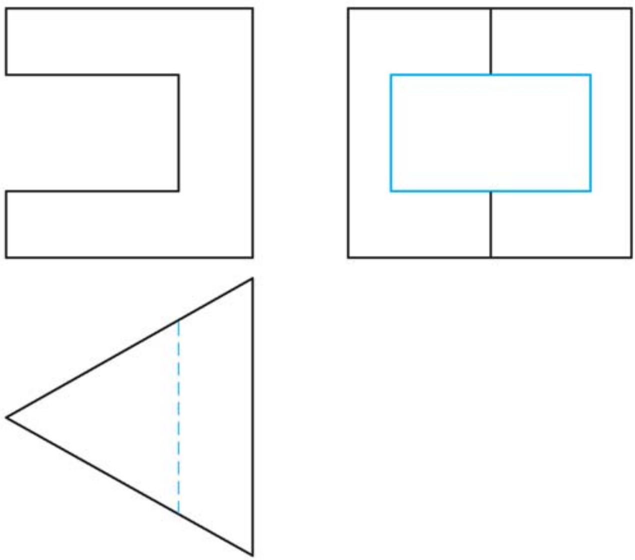
2.1 切割体

例 2-1 分析切口三棱柱三视图的正误

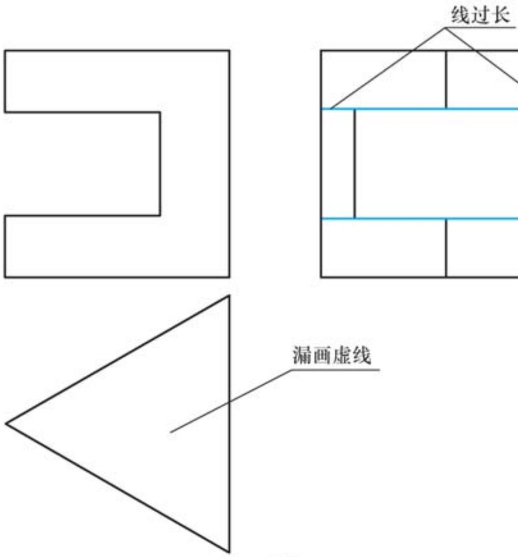
扫码看视频讲解



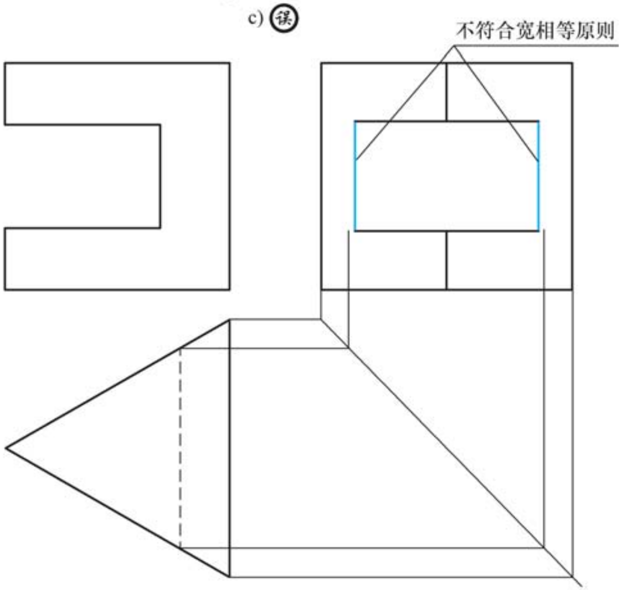
a) 立体图



b) 正



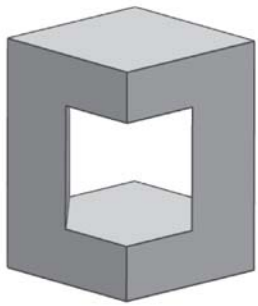
c) 误



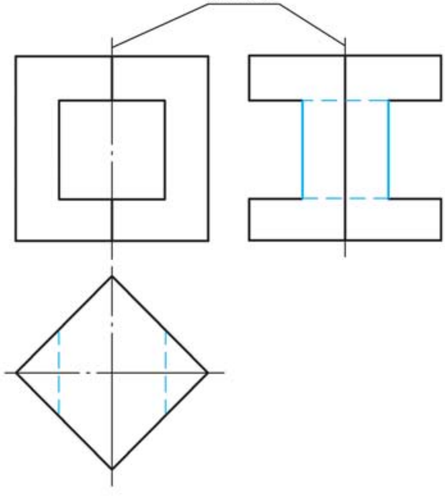
d) 误

例 2-2　分析切方孔四棱柱三视图的正误

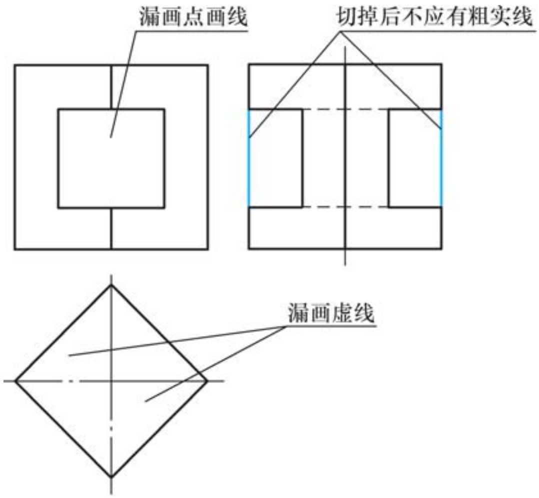
扫码看视频讲解



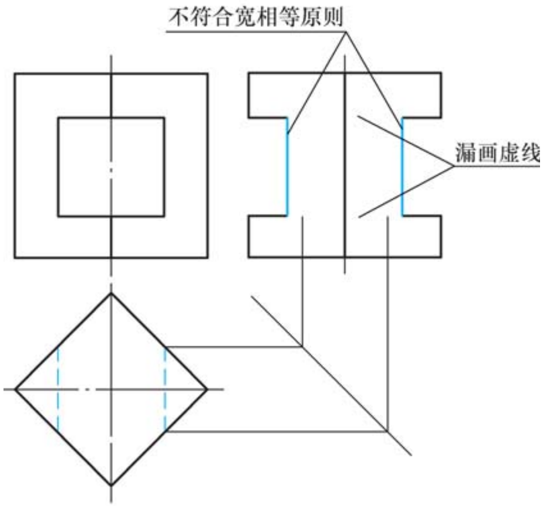
a) 立体图



b) 正

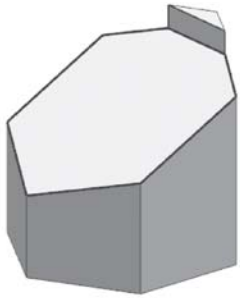


c) 误

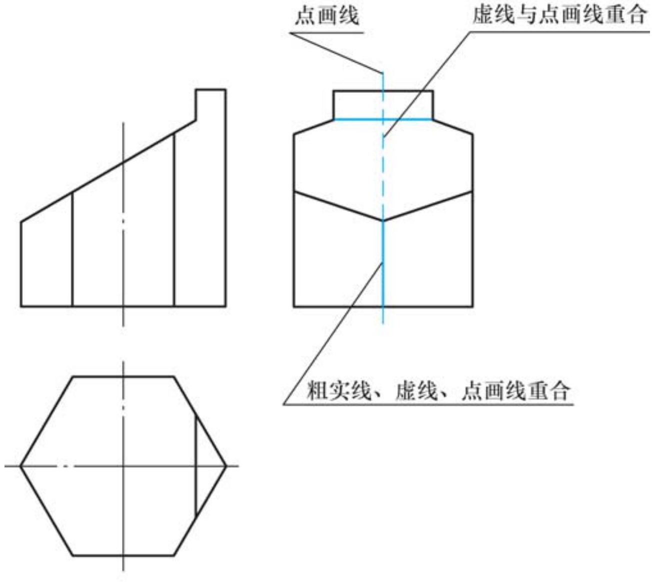


d) 误

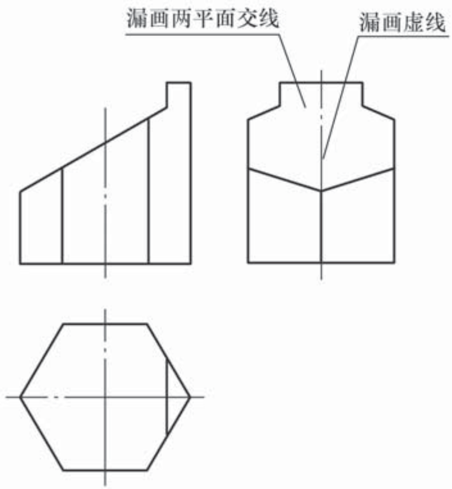
例 2-3　分析截切六棱柱三视图的正误



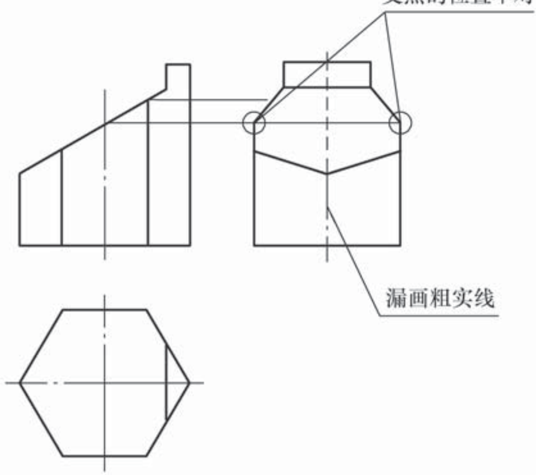
a) 立体图



b) 正



c) 误

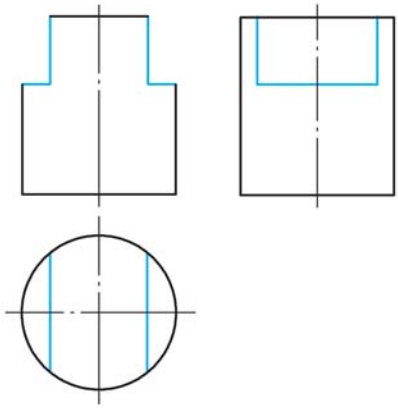


d) 误

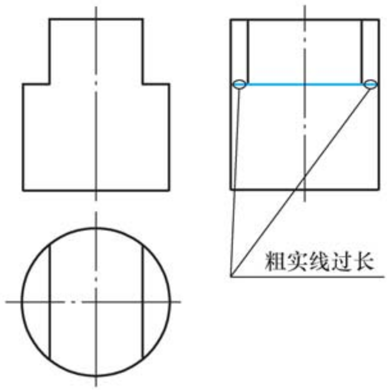
例 2-4　分析两侧截切圆柱体三视图的正误



a) 立体图



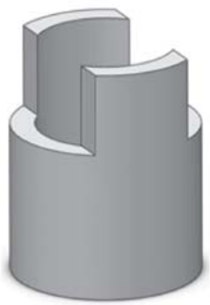
b) 正



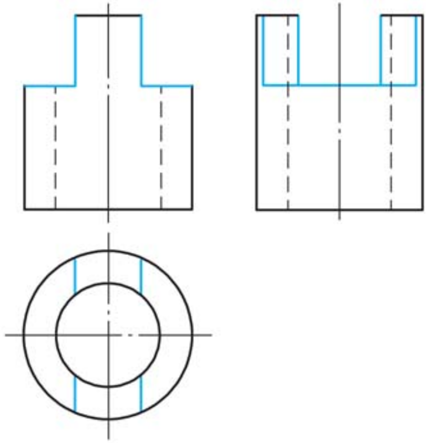
c) 误

扫码看视频讲解

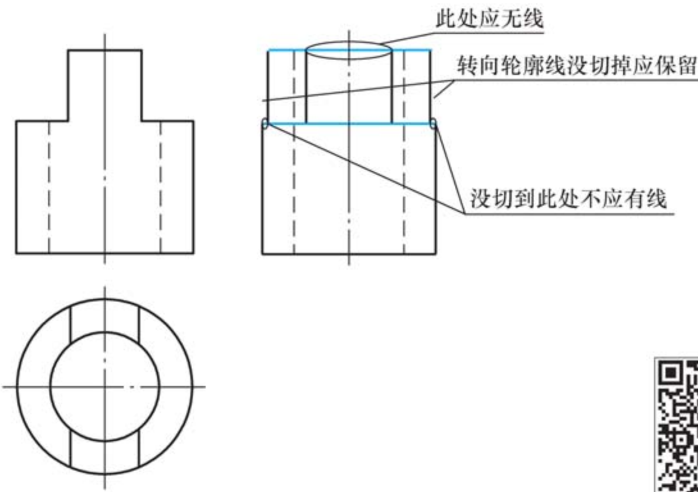
例 2-5　分析两侧截切圆柱筒三视图的正误



a) 立体图



b) 正



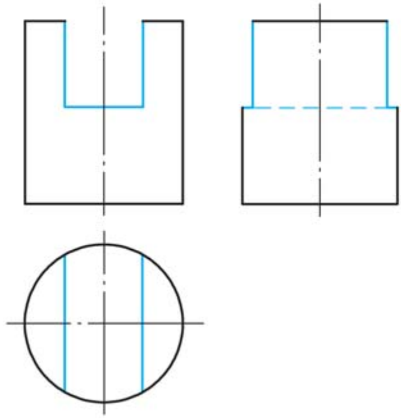
c) 误

扫码看视频讲解

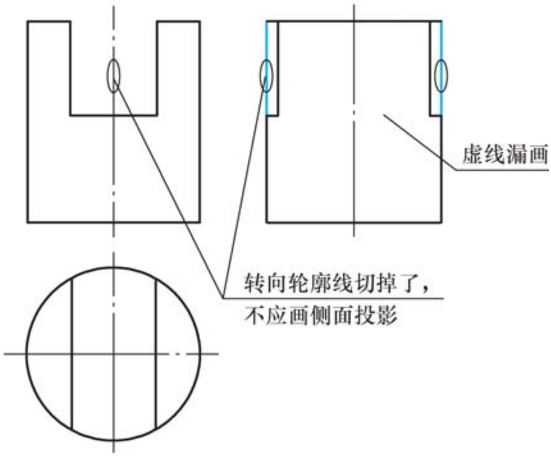
例 2-6　分析中间截切圆柱三视图的正误



a) 立体图



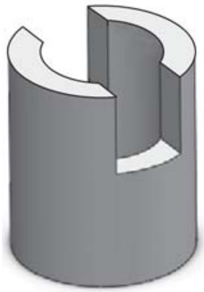
b) 正



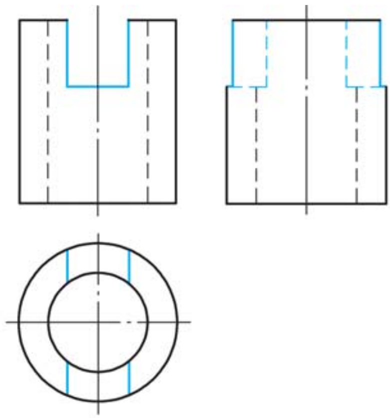
c) 误

扫码看视频讲解

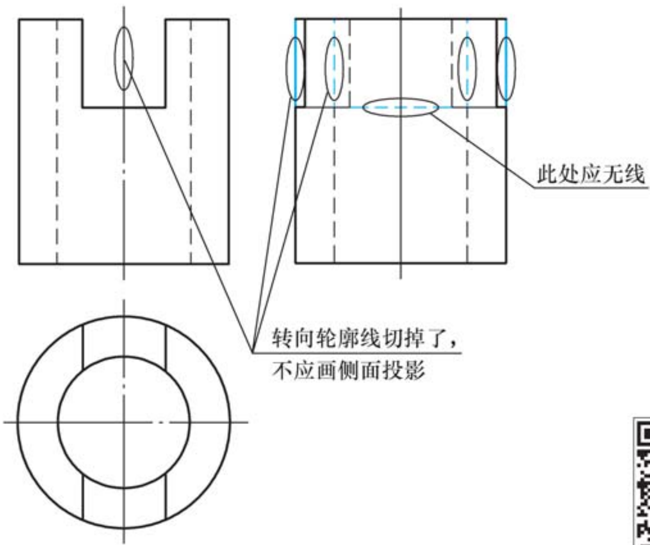
例 2-7　分析中间截切圆柱筒三视图的正误



a) 立体图



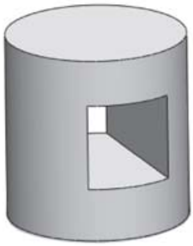
b) 正



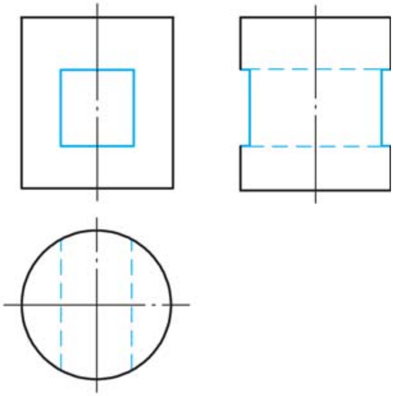
c) 误

扫码看视频讲解

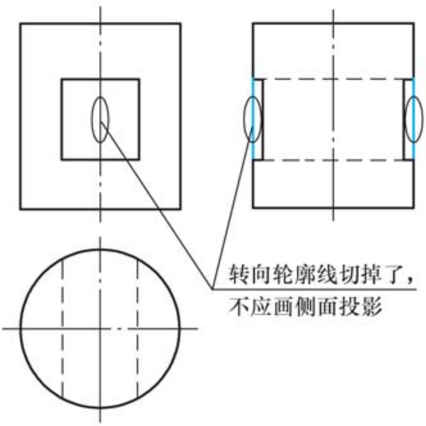
例 2-8　分析中间切方孔圆柱三视图的正误



a) 立体图

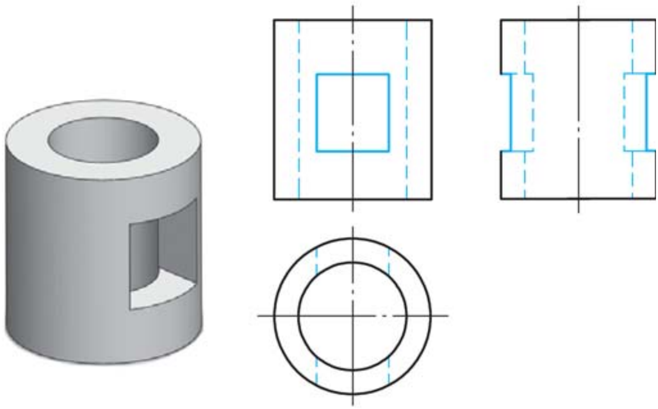


b) 正

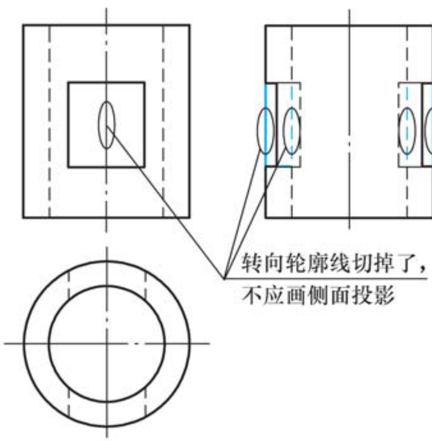


c) 误

例 2-9　分析中间切方孔圆柱筒三视图的正误



a) 立体图　　　　b) 正

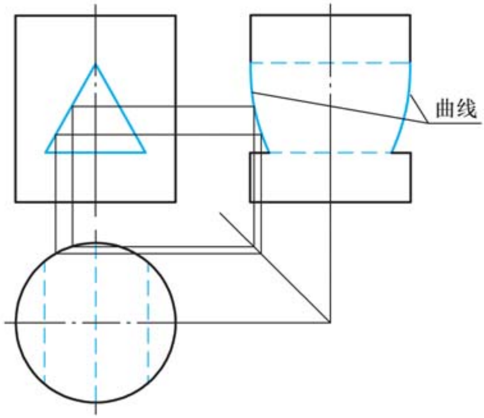


c) 误

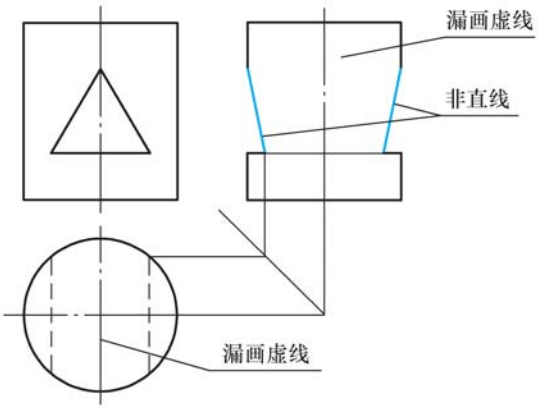
例 2-10　分析中间切孔圆柱三视图的正误



a) 立体图



b) 正



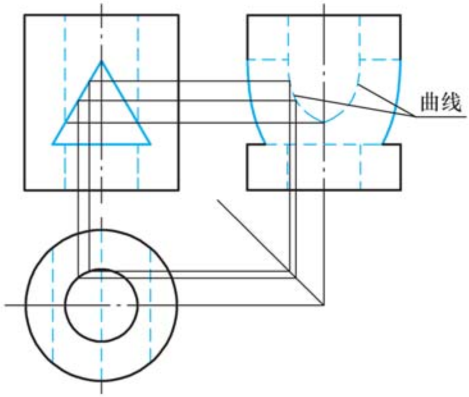
c) 误

扫码看视频讲解

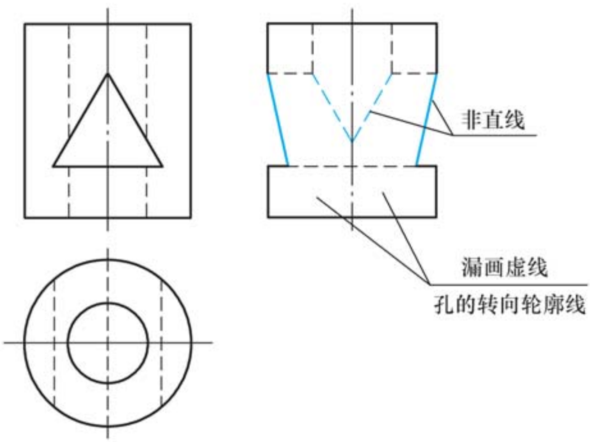
例 2-11　分析中间切孔圆柱筒三视图的正误



a) 立体图



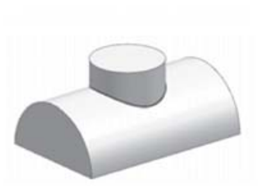
b) 正



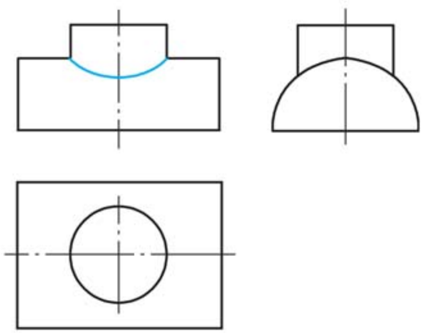
c) 误

2.2　相贯体

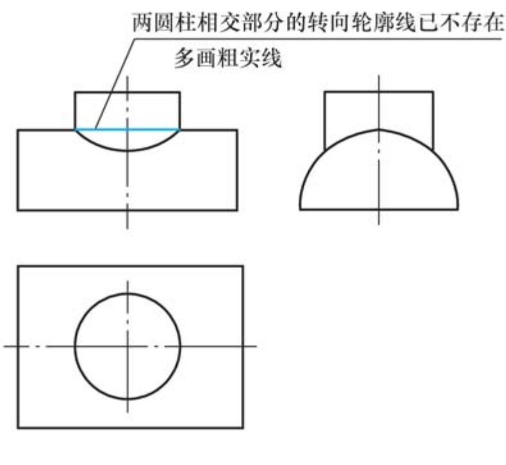
例 2-12　分析两圆柱相贯线投影的正误



a) 立体图



b) 正

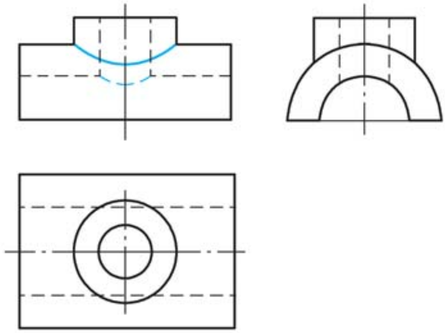


c) 误

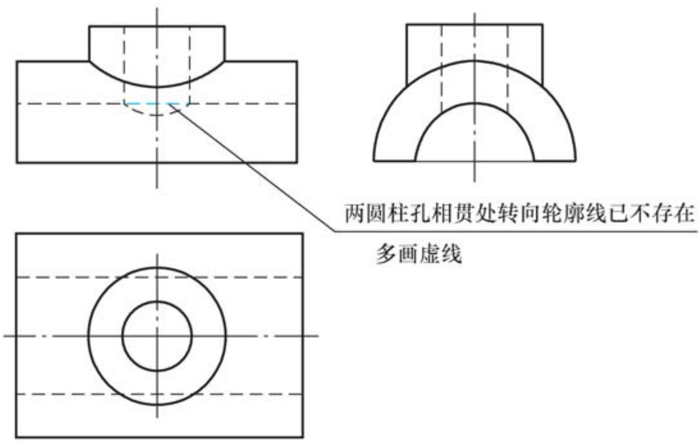
例 2-13　分析两圆柱筒相贯线投影的正误



a) 立体图

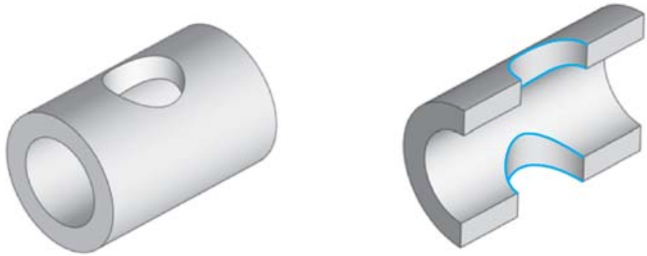


b) 正

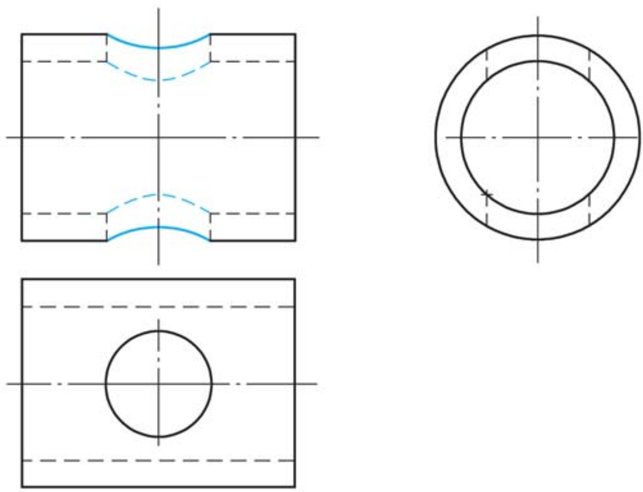


c) 误

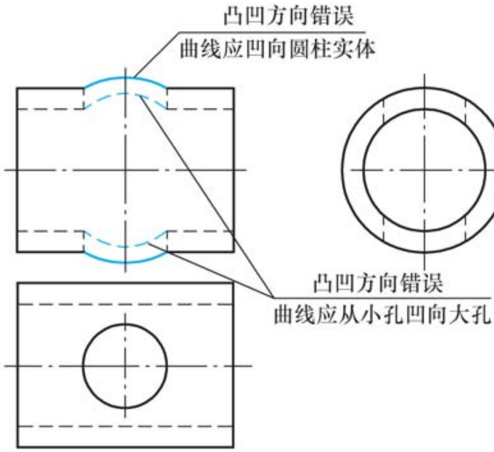
例 2-14　分析两圆柱筒相贯线投影的正误



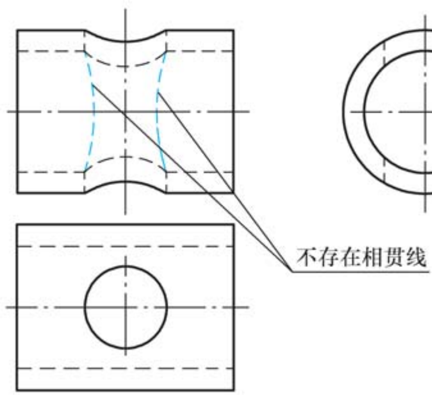
a) 立体图



b) 正



c) 误



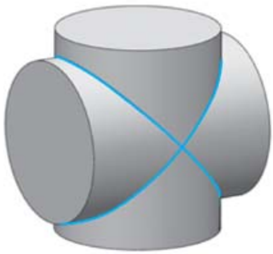
d) 误

扫码看视频讲解

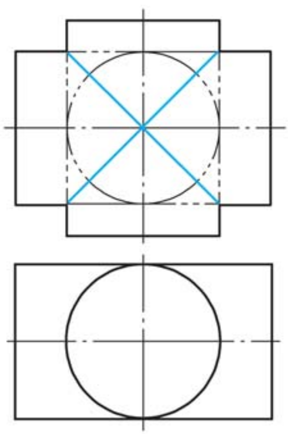
2.3 特殊相贯线

例 2-15　分析直径相同两圆柱正交相贯线投影的正误

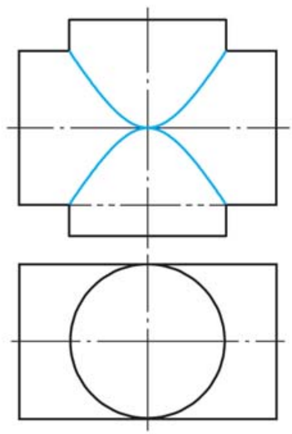
扫码看视频讲解



a) 立体图

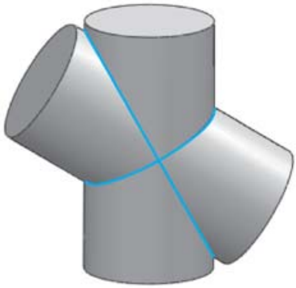


b) 正



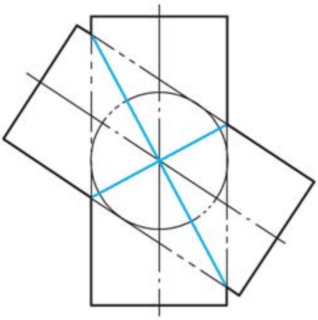
c) 误

例 2-16　分析直径相同两圆柱斜交相贯线投影的正误

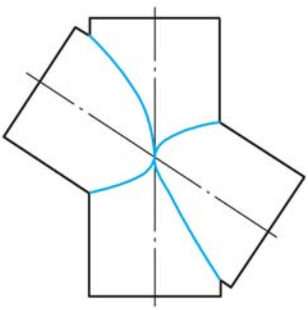


a) 立体图

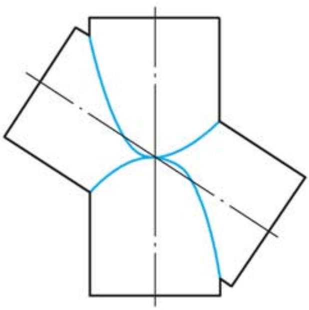
扫码看视频讲解



b) 正

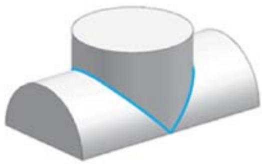


c) 误

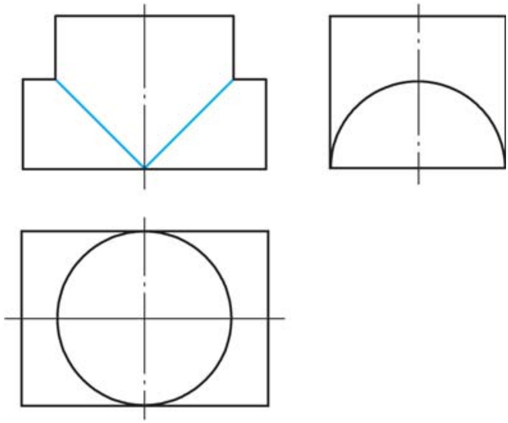


d) 误

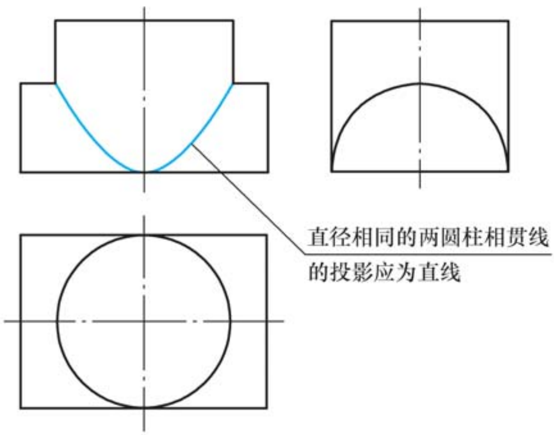
例 2-17　分析直径相同两圆柱正交时相贯线投影的正误



a) 立体图

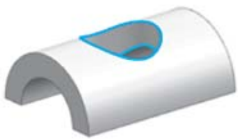


b) 正

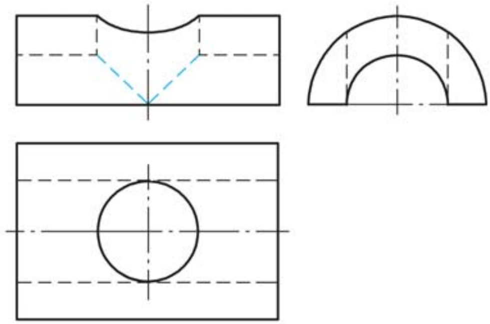


c) 误

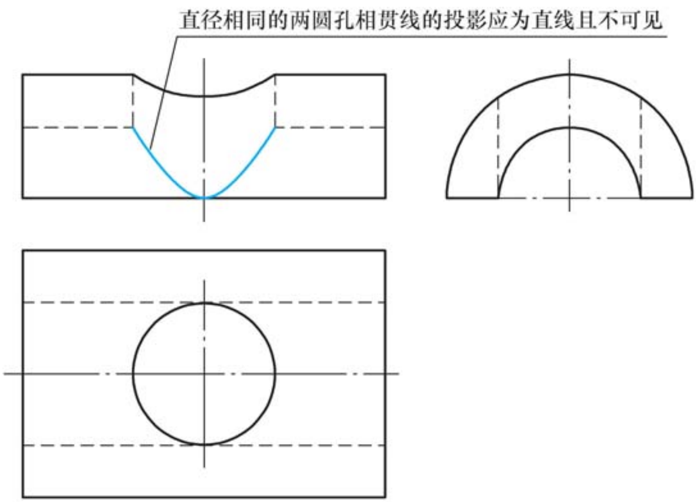
例 2-18　分析直径相同的两圆柱孔正交时相贯线投影的正误



a) 立体图



b) 正



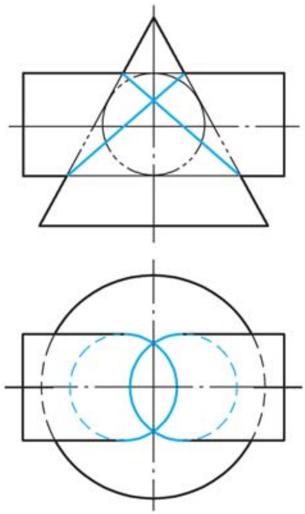
c) 误

例 2-19　分析圆柱与圆锥正交且公切一个球时相贯线投影的正误

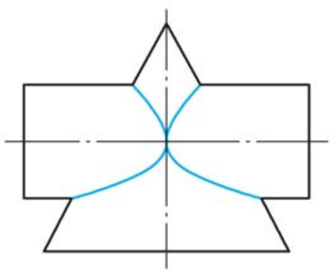
扫码看视频讲解



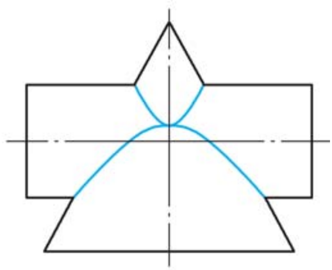
a) 立体图



b) 正

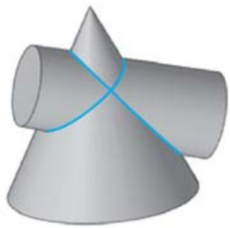


c) 误

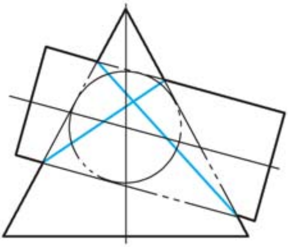


d) 误

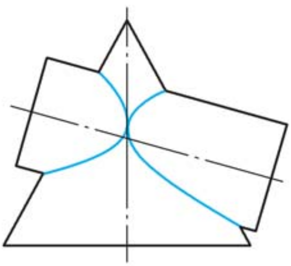
例 2-20　分析圆柱与圆锥斜交且公切一个球时相贯线投影的正误



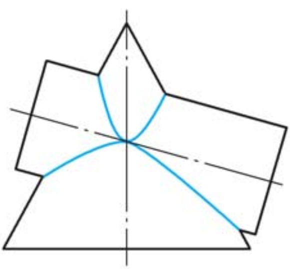
a) 立体图



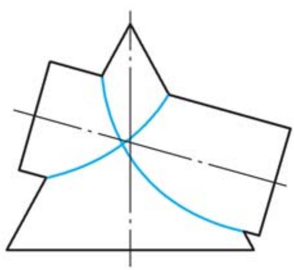
b) 正



c) 误



d) 误

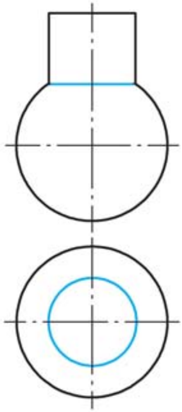


e) 误

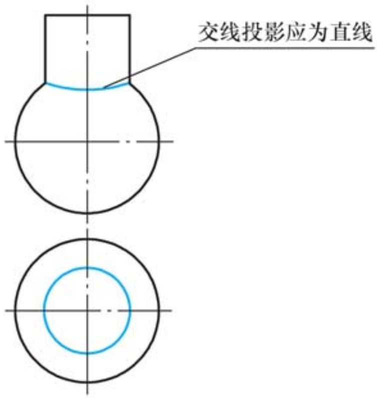
例 2-21　分析圆柱与圆球相贯线投影的正误



a) 立体图



b) 正



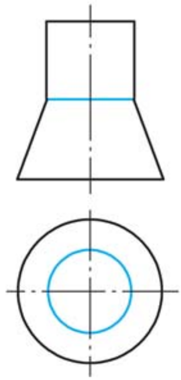
c) 误

扫码看视频讲解

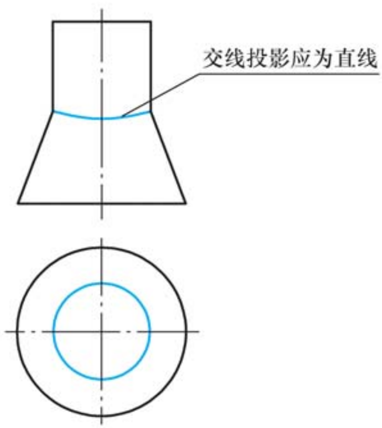
例 2-22　分析圆柱与圆锥相贯线投影的正误



a) 立体图



b) 正



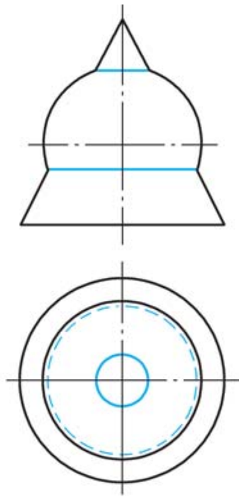
c) 误

扫码看视频讲解

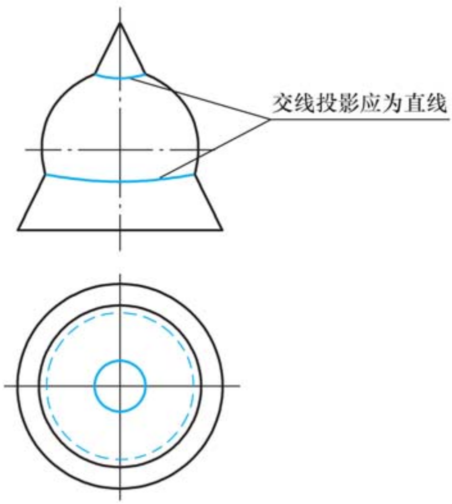
例 2-23　分析圆锥与圆球相贯线投影的正误



a) 立体图

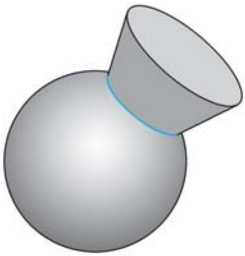


b) 正

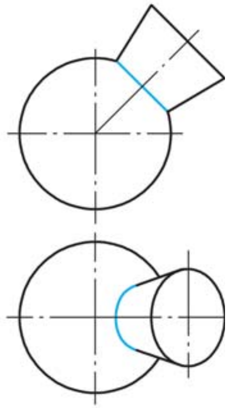


c) 误

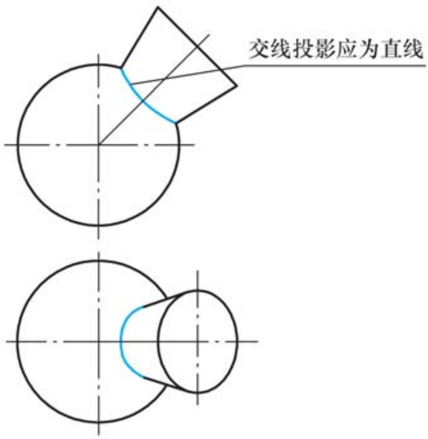
例 2-24　分析圆锥与圆球相贯线投影的正误



a) 立体图

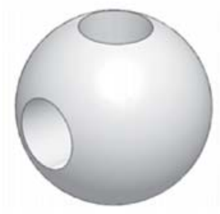


b) 正



c) 误

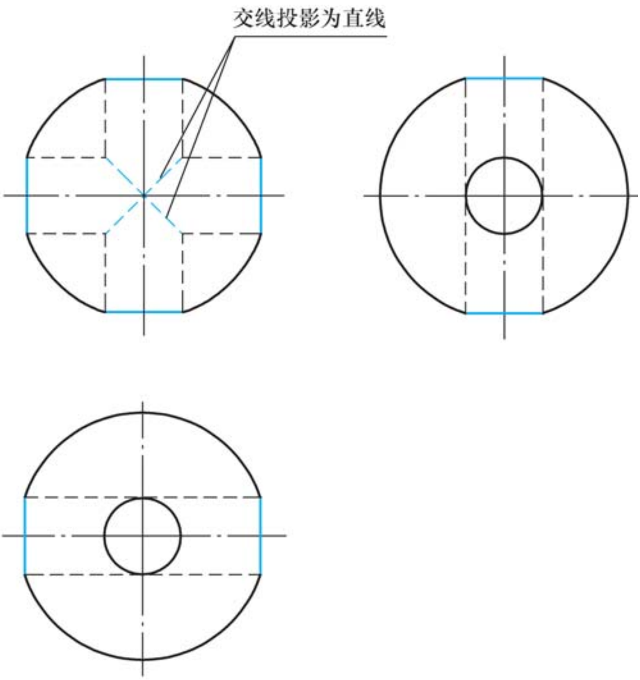
例 2-25　分析圆球上下、左右打孔且孔的直径相同时相贯线投影的正误



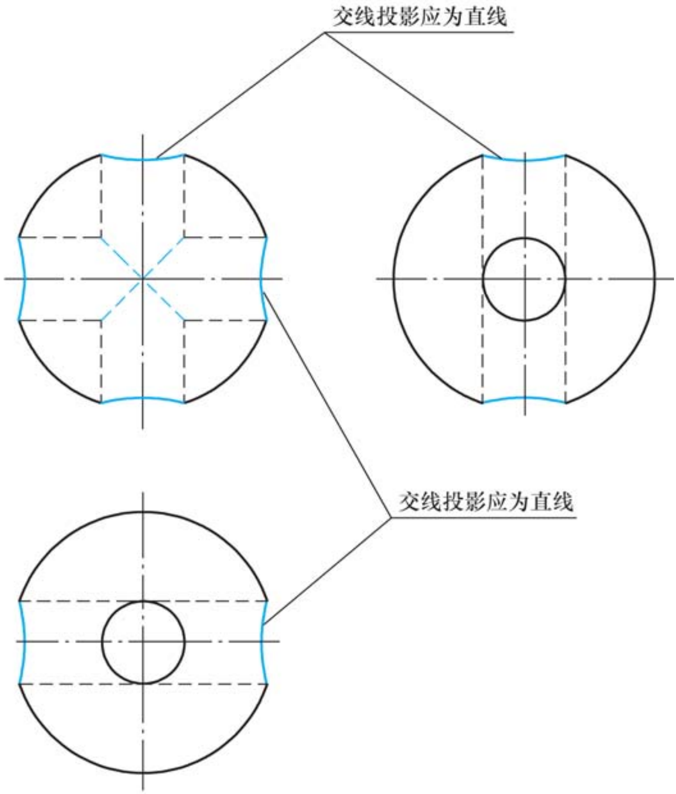
a) 立体图



b) 剖切立体图



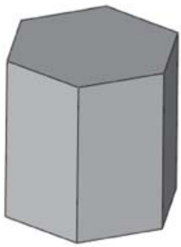
c) 正



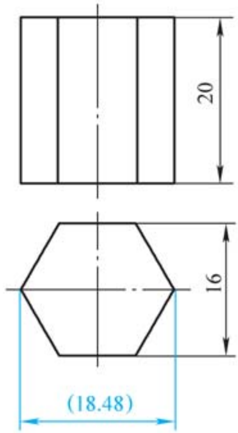
d) 误

2.4　切割体尺寸标注

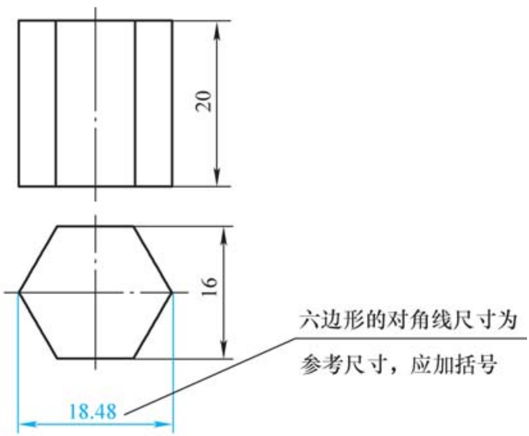
例 2-26　分析六棱柱尺寸标注的正误



a) 立体图



b) 正



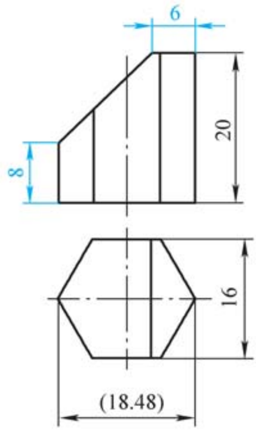
c) 误

扫码看视频讲解

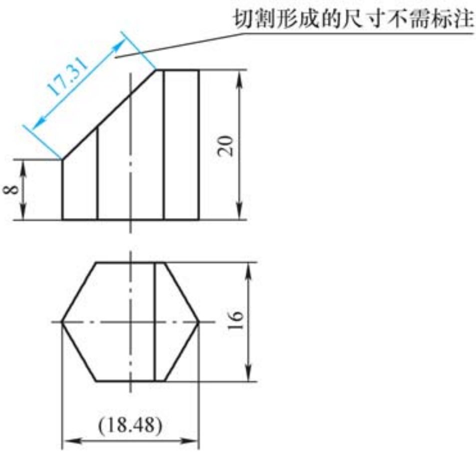
例 2-27　分析六棱柱切割体尺寸标注的正误



a) 立体图

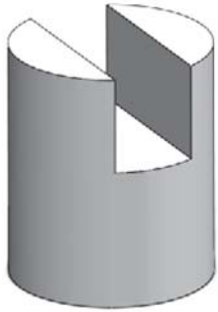


b) 正

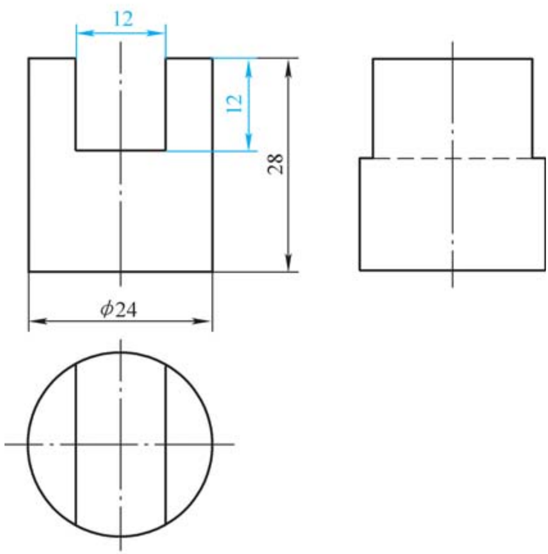


c) 误

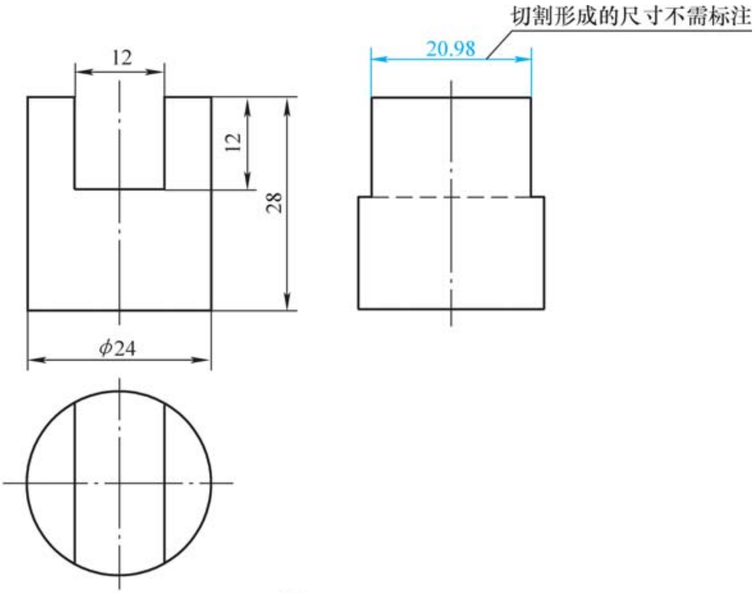
例 2-28　分析圆柱切割体的尺寸标注正误



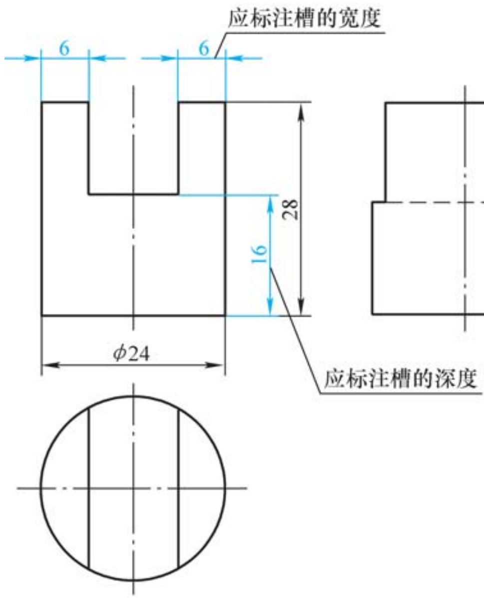
a) 立体图



b) 正

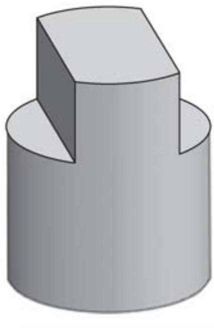


c) 误

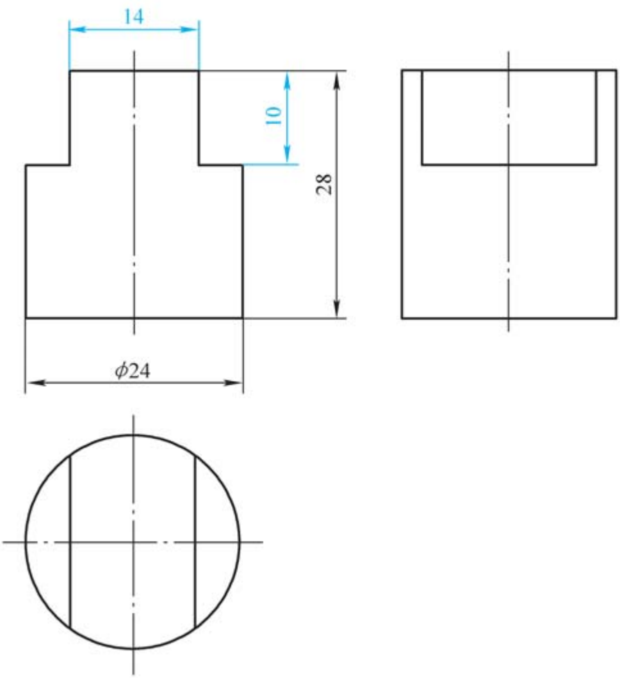


d) 误

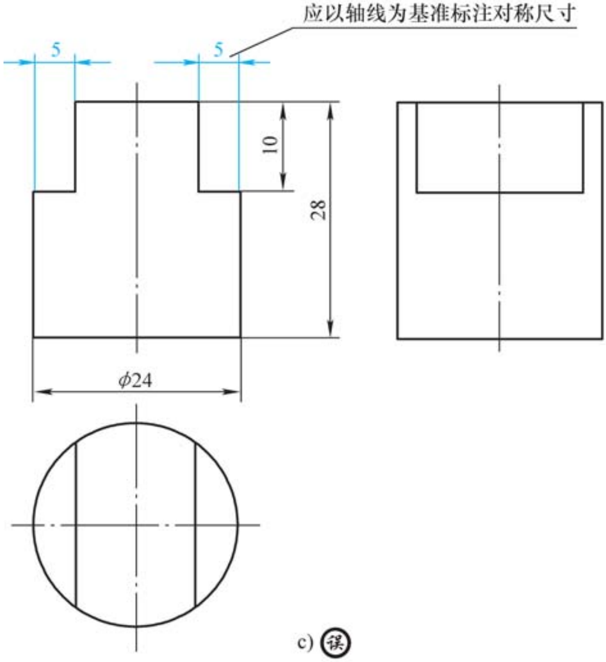
例 2-29　分析圆柱切割体的尺寸标注正误



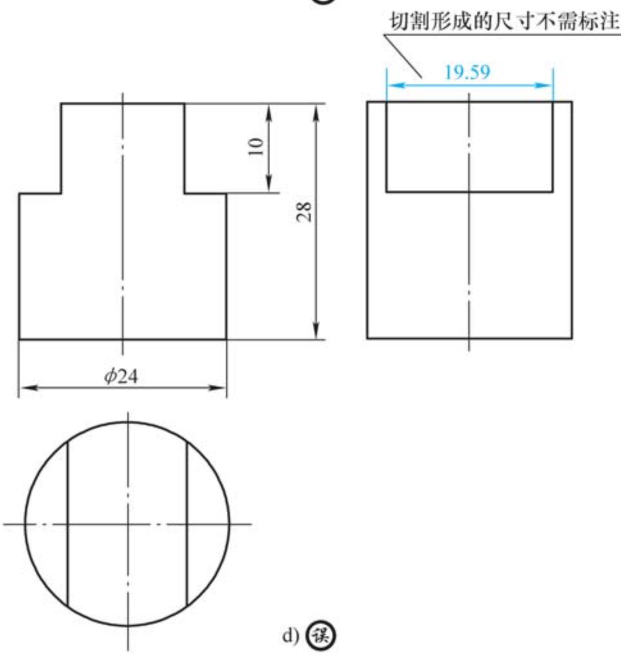
a) 立体图



b) 正

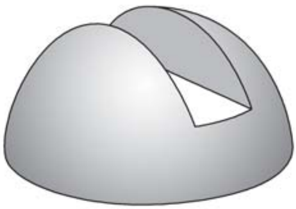


c) 误

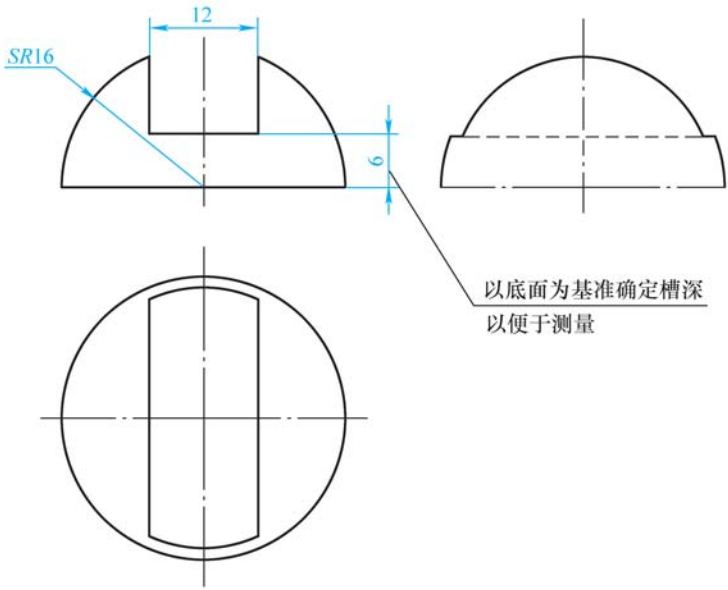


d) 误

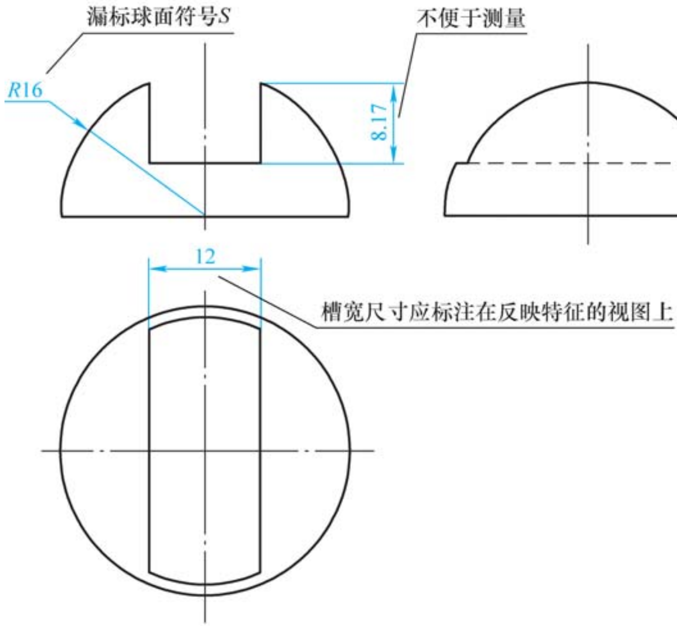
例 2-30　分析半球切割体的尺寸标注正误



a) 立体图



b) 正



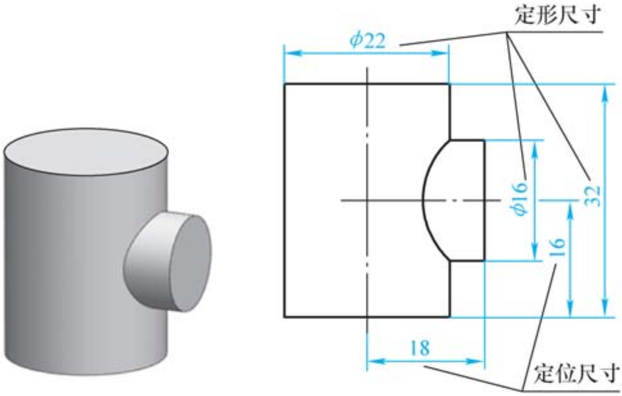
c) 误

说明

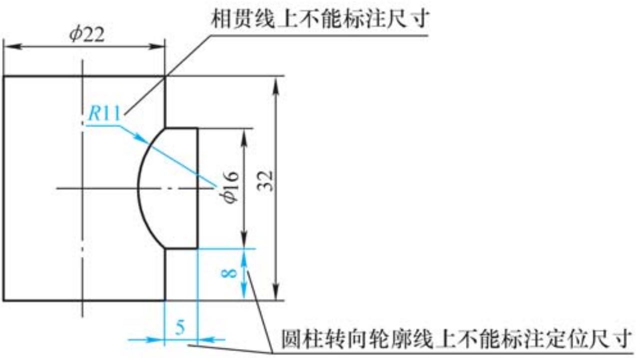
切割体的尺寸标注，通常是先标注基本形体的定形尺寸，再标注截切位置尺寸。由于截交线是自然形成的，所以，在截交线上不能标注尺寸。

2.5 相贯体尺寸标注

例 2-31 分析两圆柱相贯体的尺寸标注正误

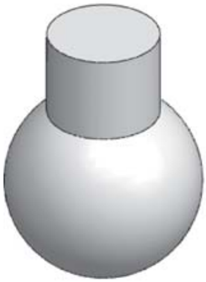


a) 立体图　　b) 正

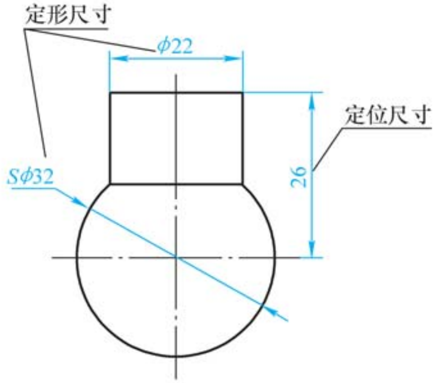


c) 误

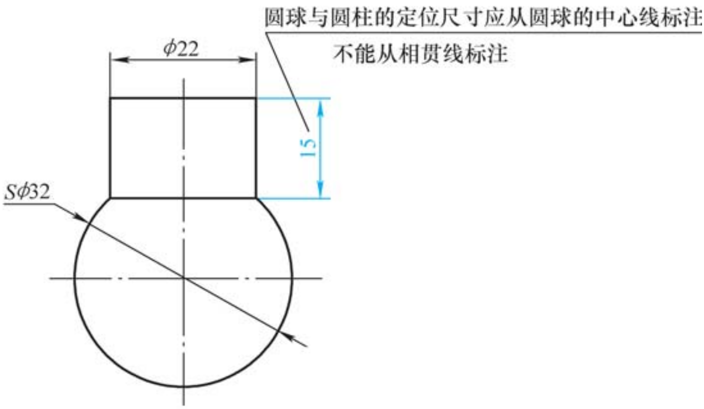
例 2-32　分析圆柱与圆球相贯体的尺寸标注正误



a) 立体图

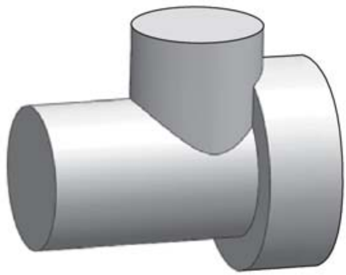


b) 正

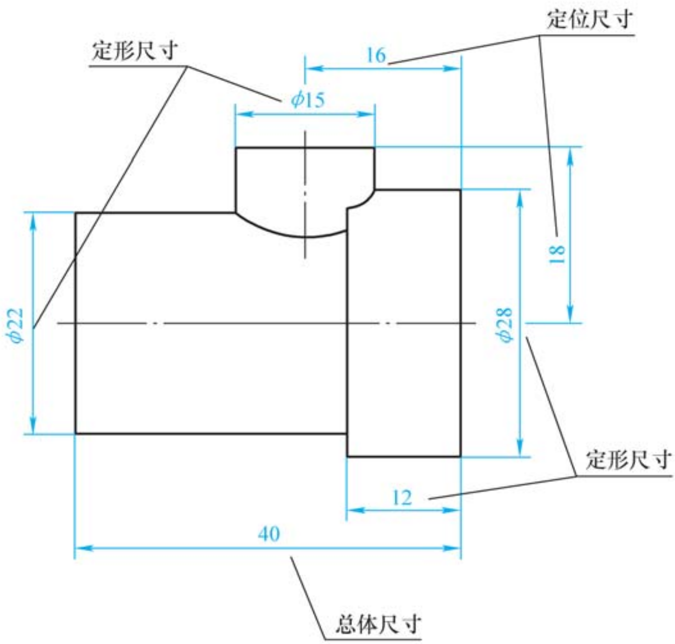


c) 误

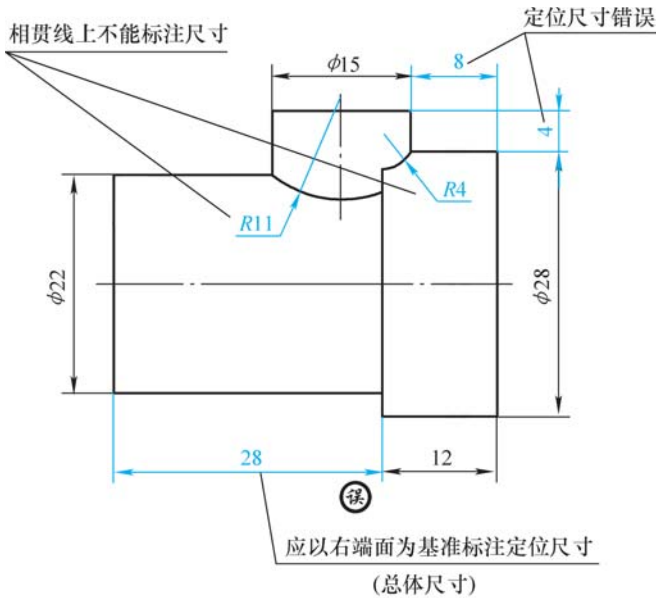
例 2-33　分析圆柱相贯体的尺寸标注正误



a) 立体图



b) 正



c) 误

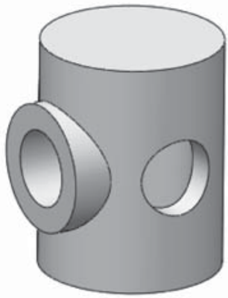
说明

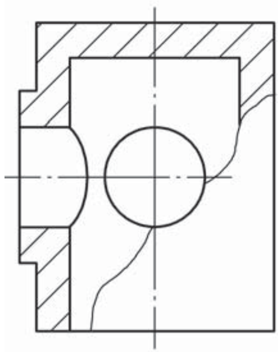
相贯体的尺寸标注，通常是先标注基本形体的定形尺寸，再标注相贯体之间的位置尺寸。圆柱体一般是以回转轴线和端面为基准，所以，定位尺寸是标注各圆柱基准之间的尺寸。

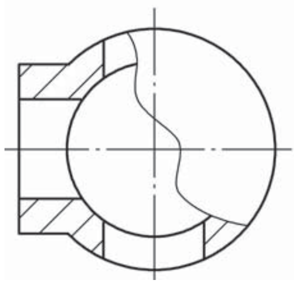
练一练

练习 2-1　根据主俯视图补画半剖左视图

扫码看视频讲解

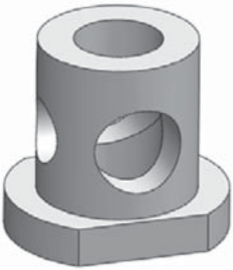


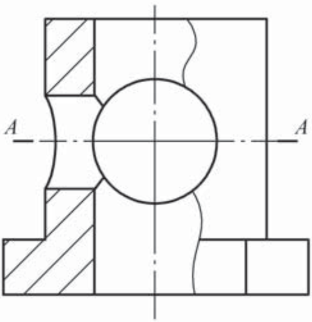


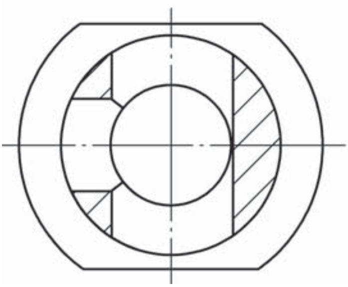


练习 2-2　根据主俯视图补画半剖左视图



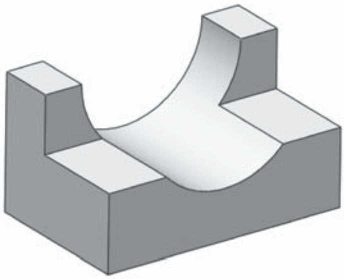


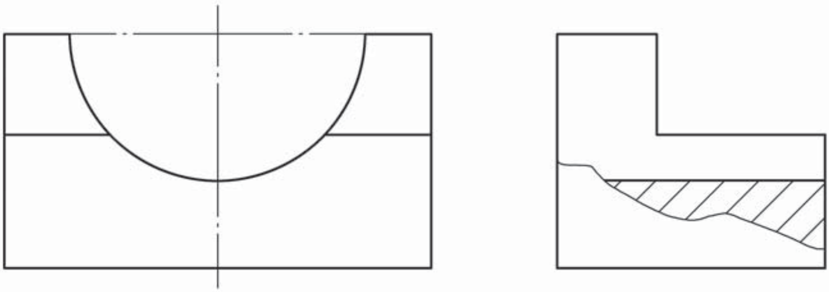




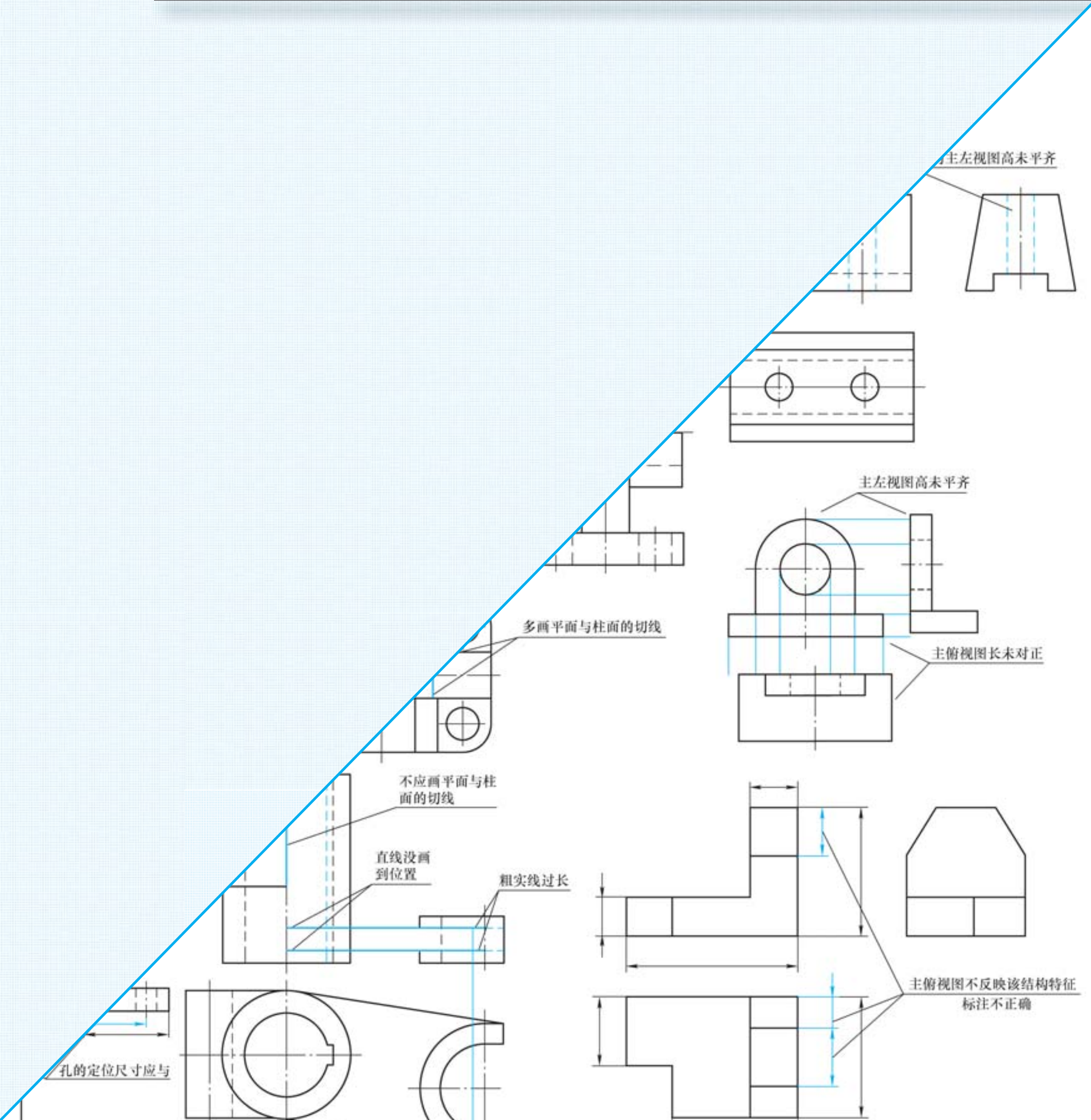
练习 2-3　根据主左视图补画俯视图

扫码看视频讲解





第3章 组合体



主左视图高未平齐
主左视图高未平齐
多画平面与柱面的切线
主俯视图长未对正
不应画平面与柱面的切线
直线没画到位置
粗实线过长
主俯视图不反映该结构特征
标注不正确
孔的定位尺寸应与

3.1　组合体三视图投影规律

三视图要符合“三等”规律：

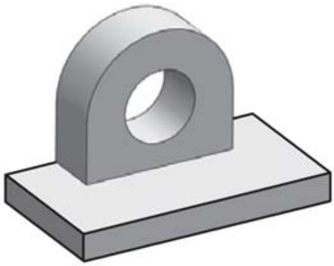
主视图、俯视图“长对正”——等长；

主视图、左视图“高平齐”——等高；

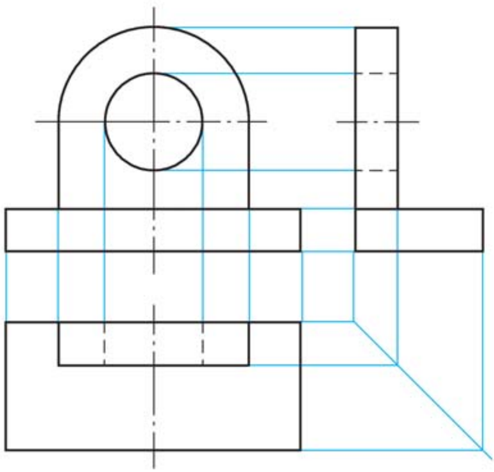
俯视图、左视图“宽相等”——等宽。

例 3-1　分析三视图投影规律

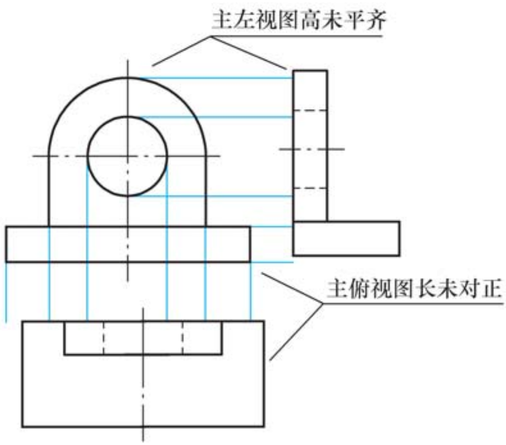
扫码看视频讲解



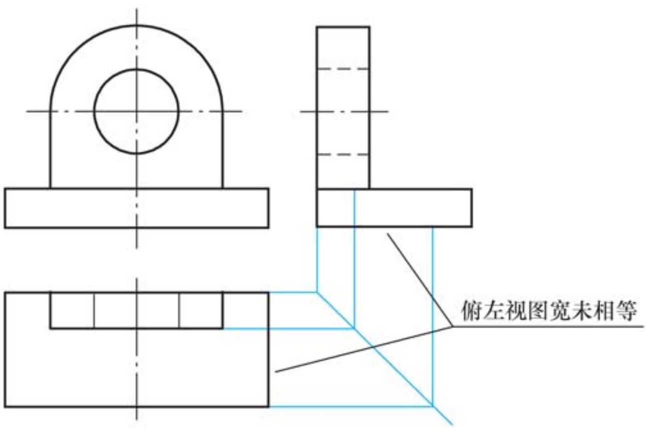
a) 立体图



b) 正



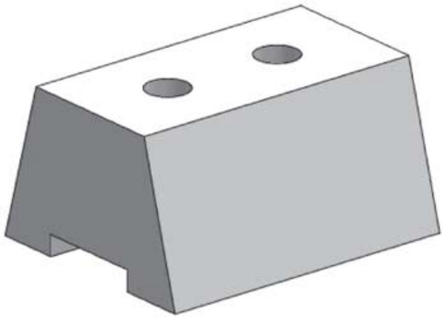
c) 误



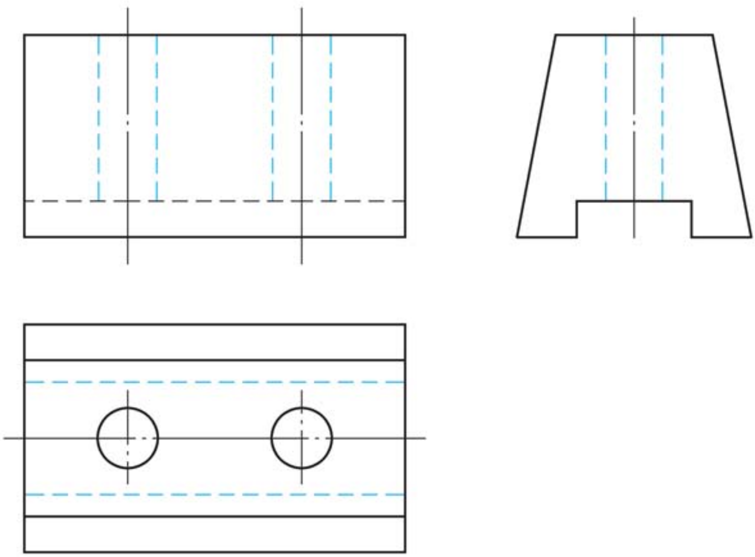
d) 误

例 3-2　分析三视图投影规律

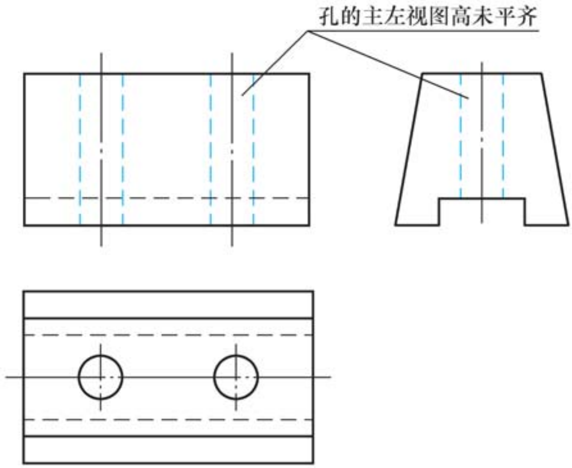
扫码看视频讲解



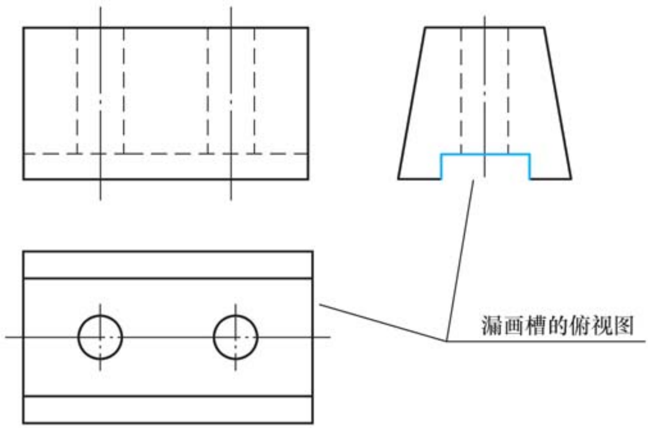
a) 立体图



b) 正



c) 误

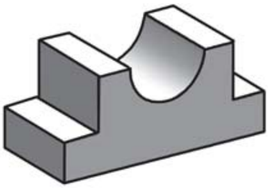


d) 误

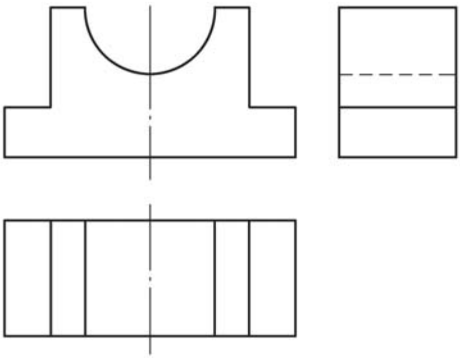
3.2 组合体相邻表面之间的关系

例 3-3 分析相邻表面共面与不共面关系

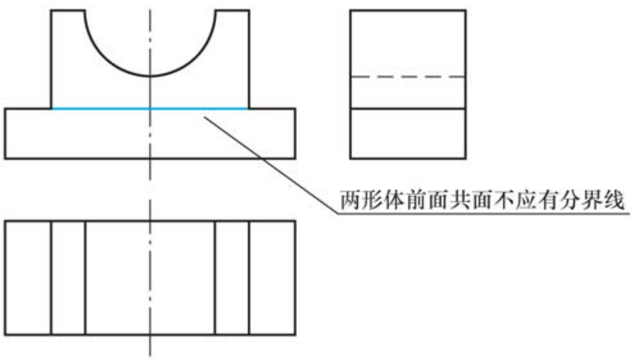
扫码看视频讲解



a) 立体图

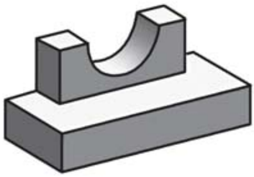


b) 正



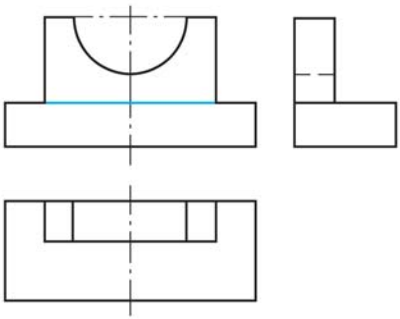
c) 误

例 3-4　分析相邻表面共面与不共面关系

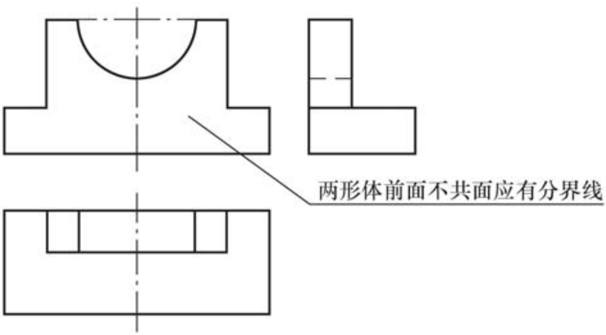


a) 立体图

扫码看视频讲解

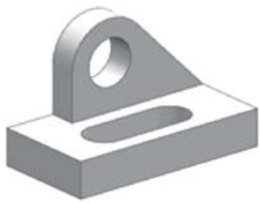


b) 正

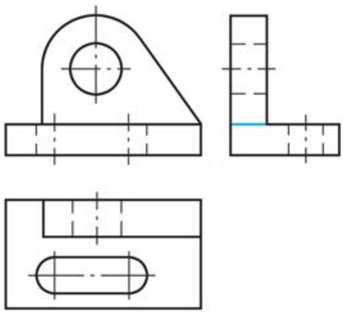


c) 误

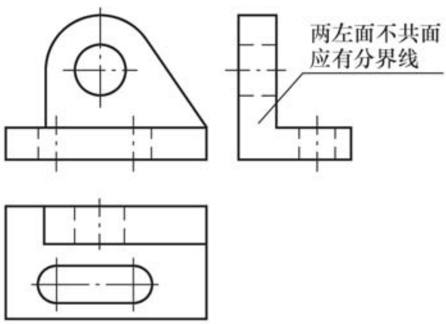
例 3-5　分析相邻表面共面与不共面关系



a) 立体图

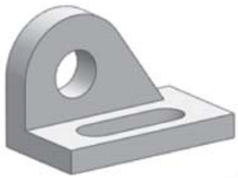


b) 正

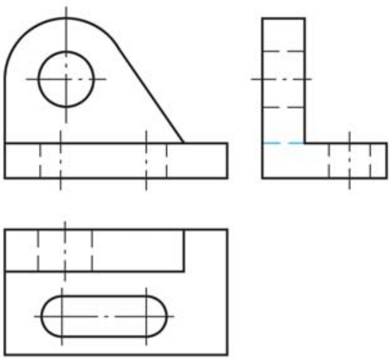


c) 误

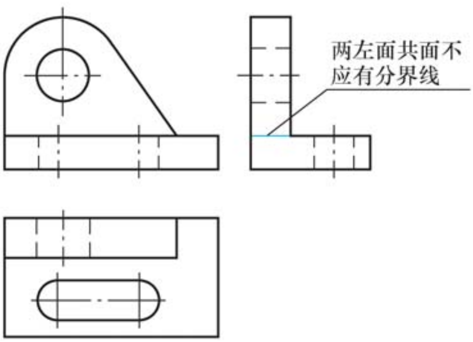
例 3-6　分析相邻表面共面与不共面关系



a) 立体图

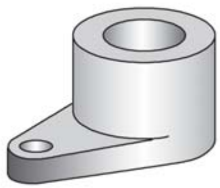


b) 正

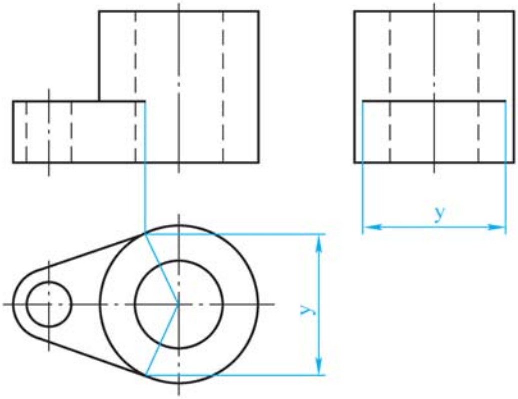


c) 误

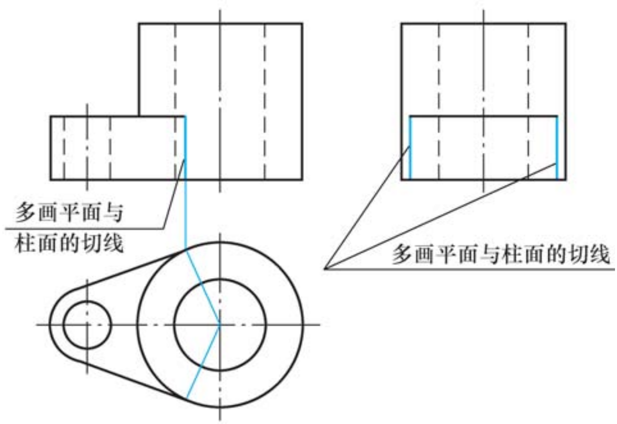
例 3-7　分析相邻表面相切与相交关系



a) 立体图



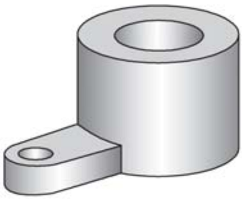
b) 正



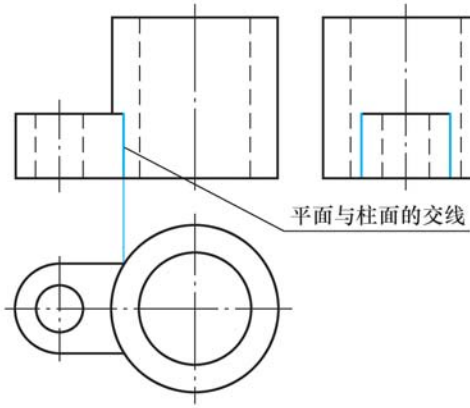
c) 误

扫码看视频讲解

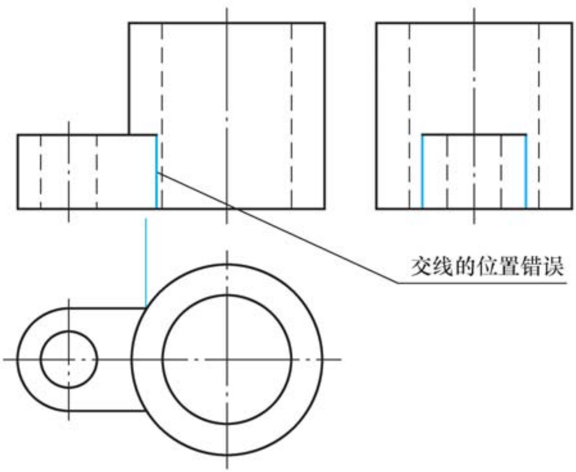
例 3-8　分析相邻表面相切与相交关系



a) 立体图



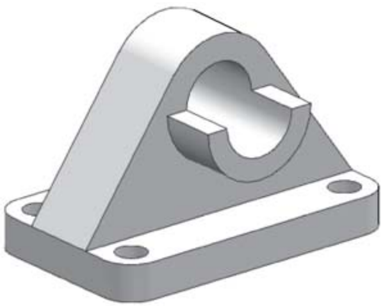
b) 正



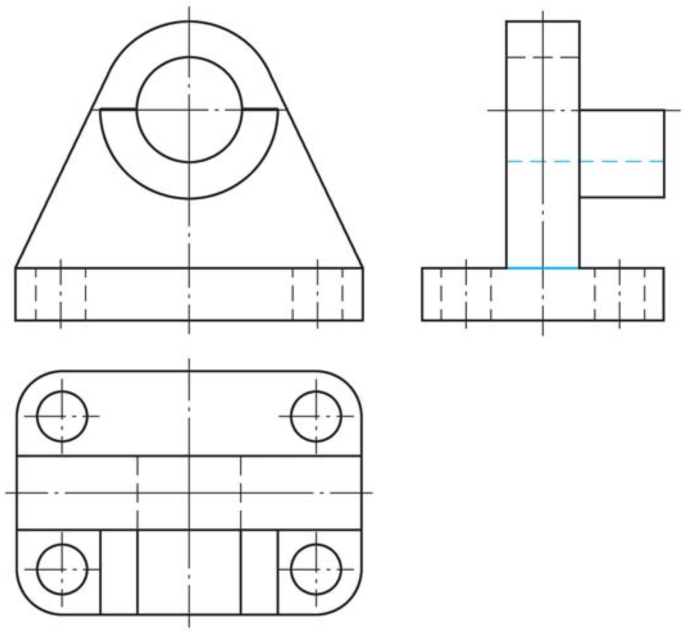
c) 误

扫码看视频讲解

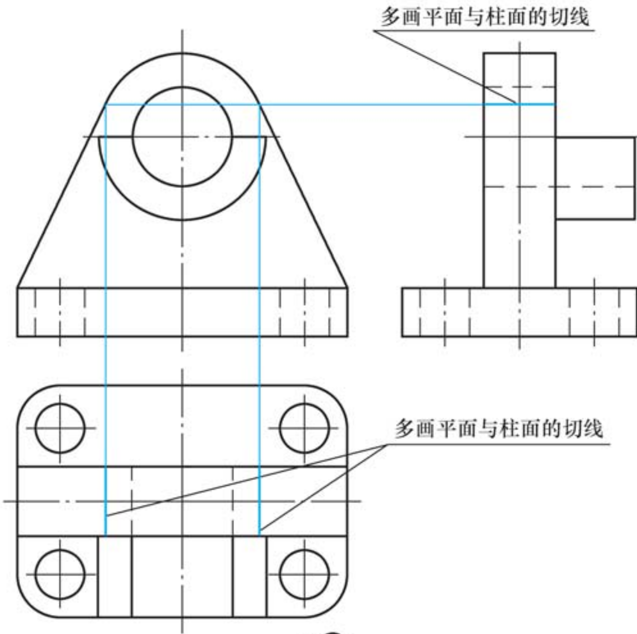
例 3-9　分析组合体三视图的正误



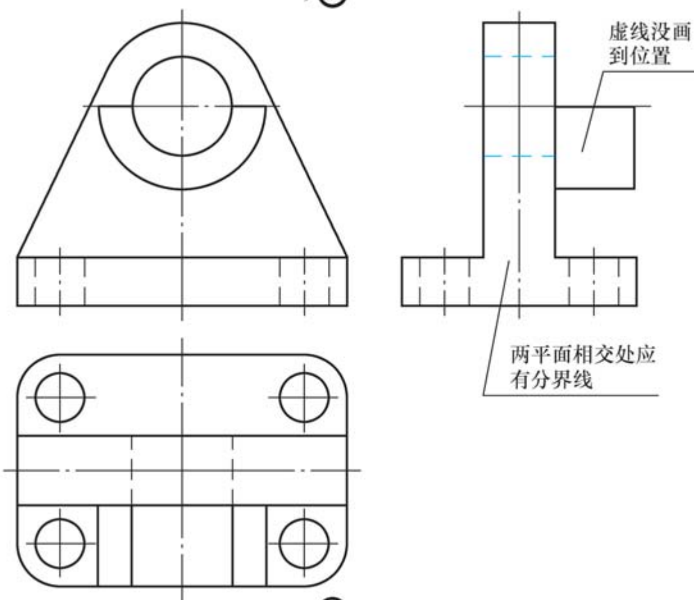
a) 立体图



b) 正



c) 误

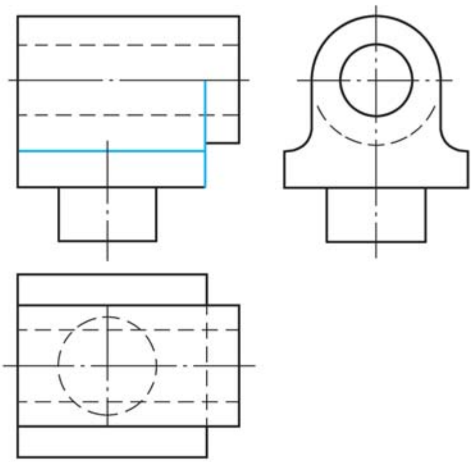


d) 误

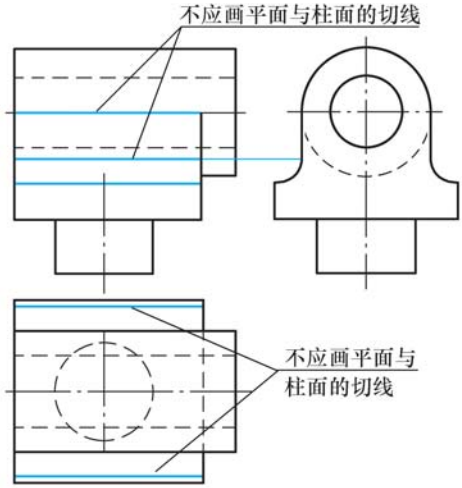
例 3-10　分析组合体三视图的正误



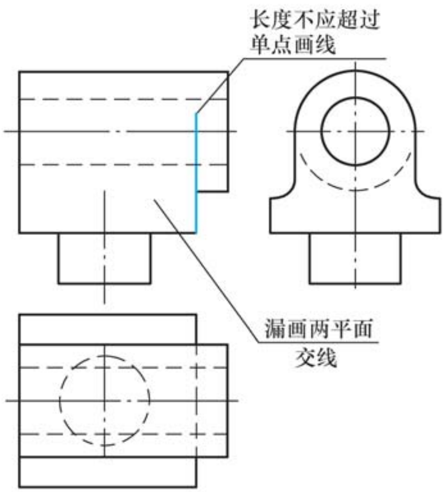
a) 立体图



b) 正

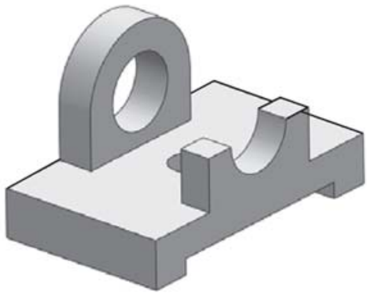


c) 误

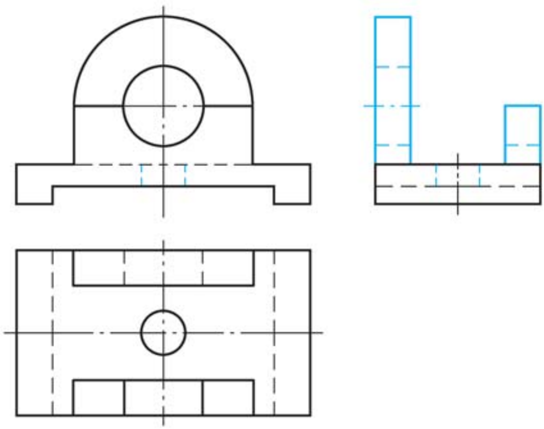


d) 误

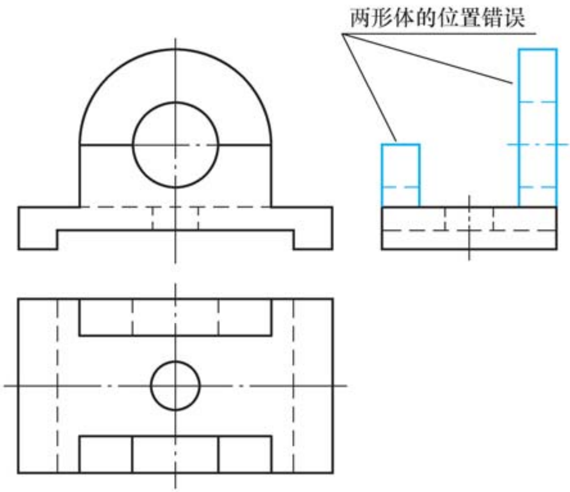
例 3-11　分析组合体三视图的正误



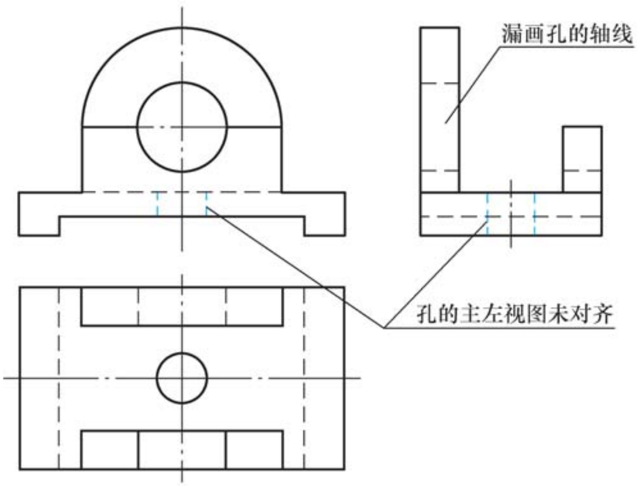
a) 立体图



b) 正

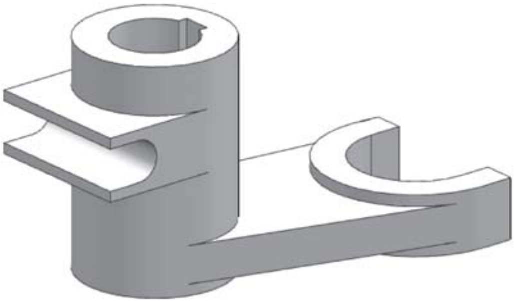


c) 误

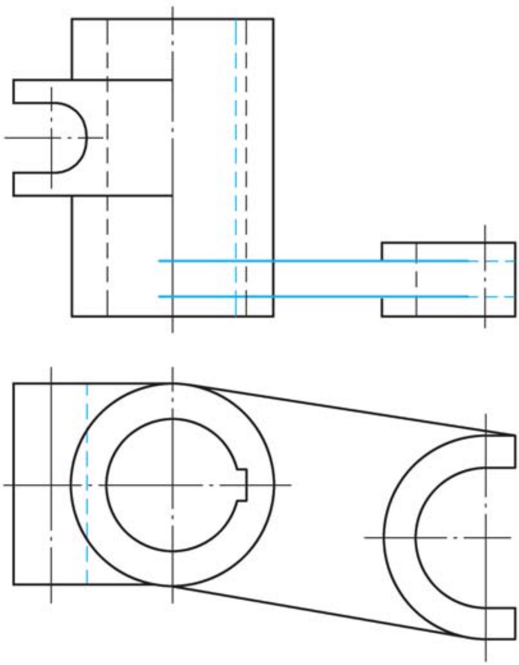


d) 误

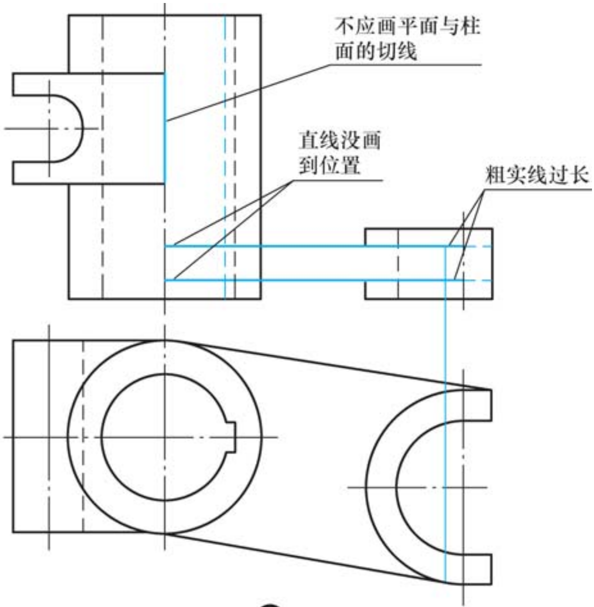
例 3-12　分析组合体三视图的正误



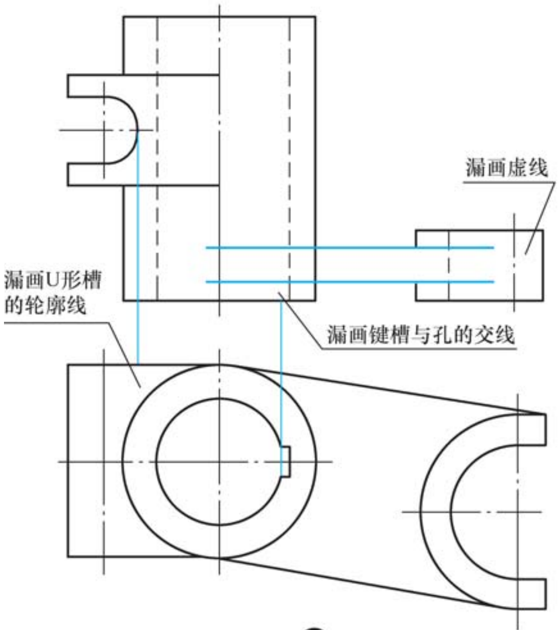
a)



b) 正



c) 误

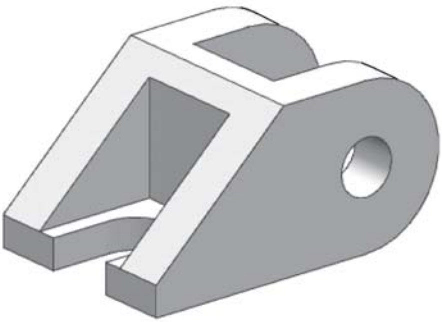


d) 误

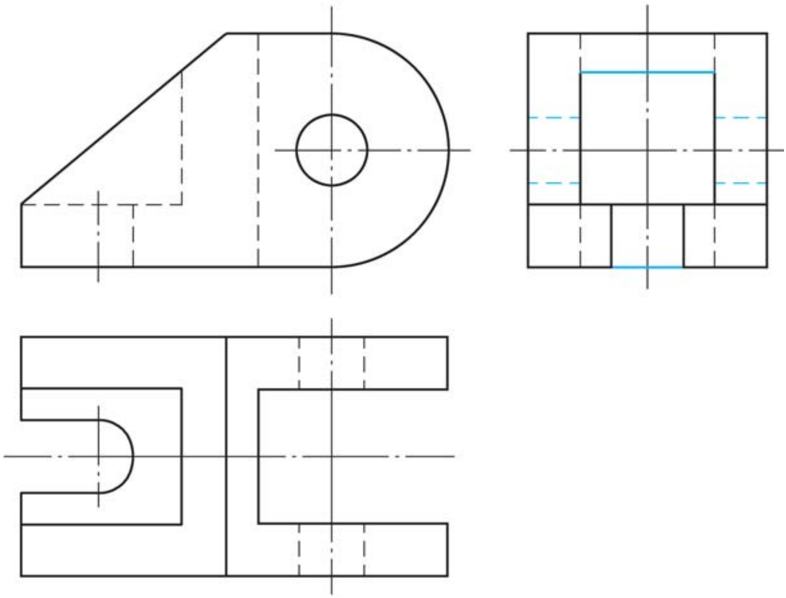
例 3-13　分析组合体三视图的正误



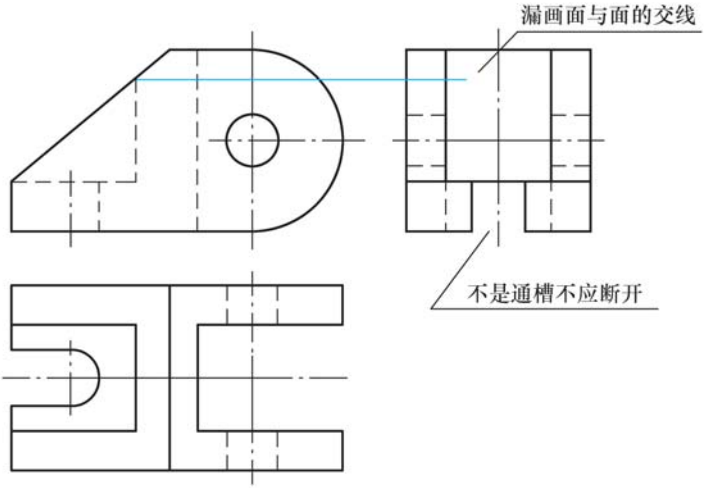
扫码看视频讲解



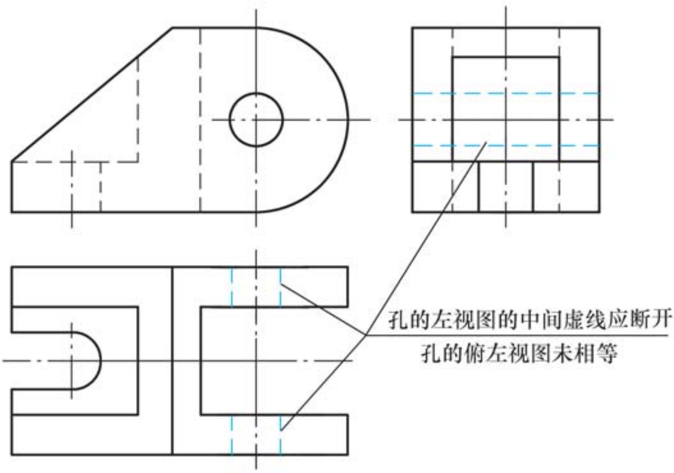
a) 立体图



b) 正



c) 误



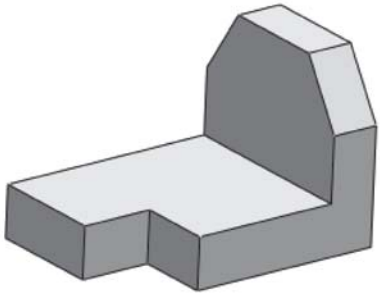
d) 误

3.3 组合体尺寸标注

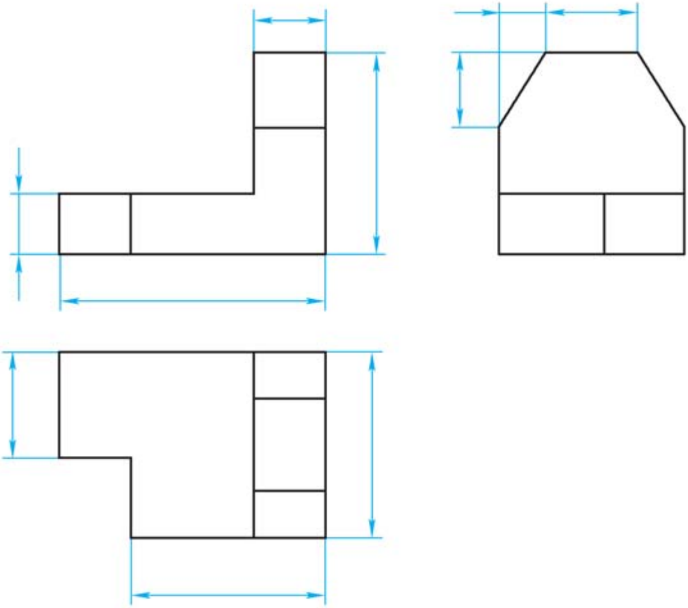
例 3-14 分析组合体三视图尺寸标注的正误



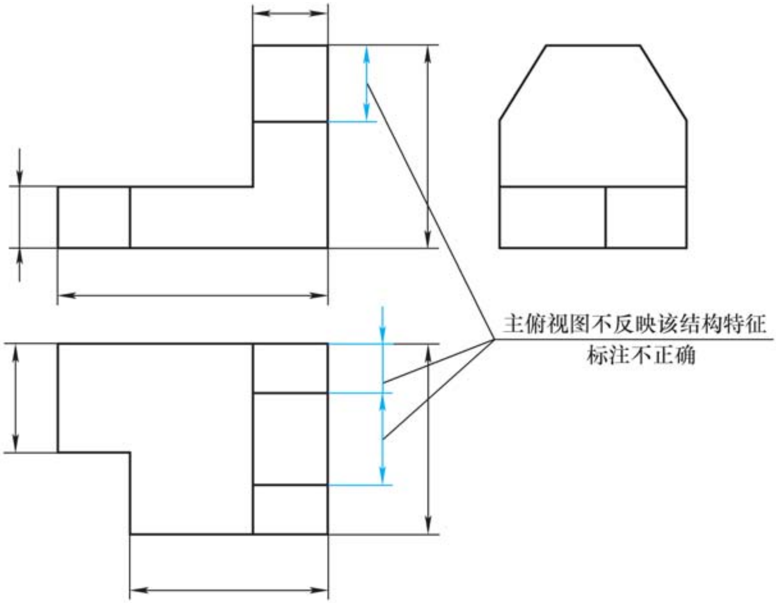
扫码看视频讲解



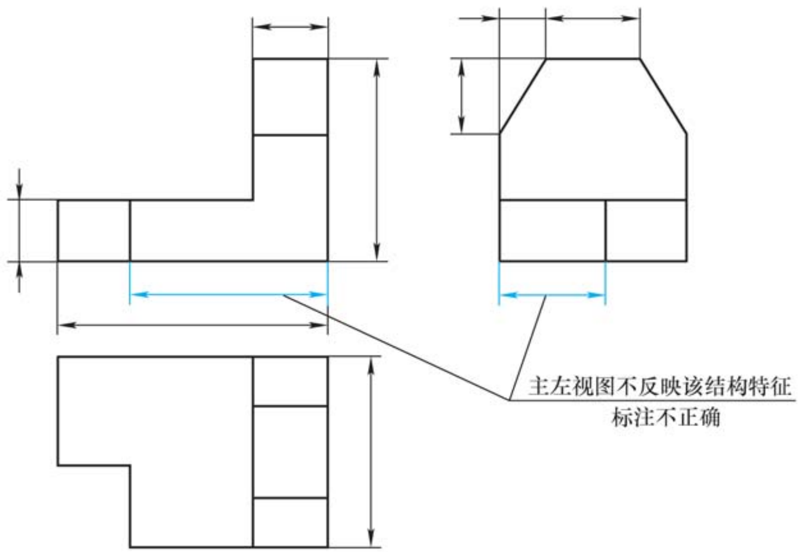
a) 立体图



b) 正



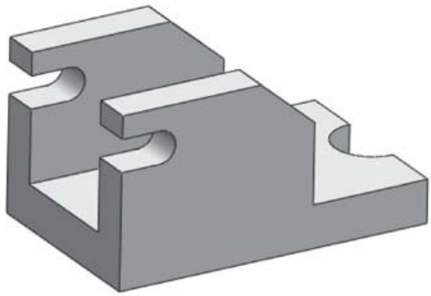
c) 误



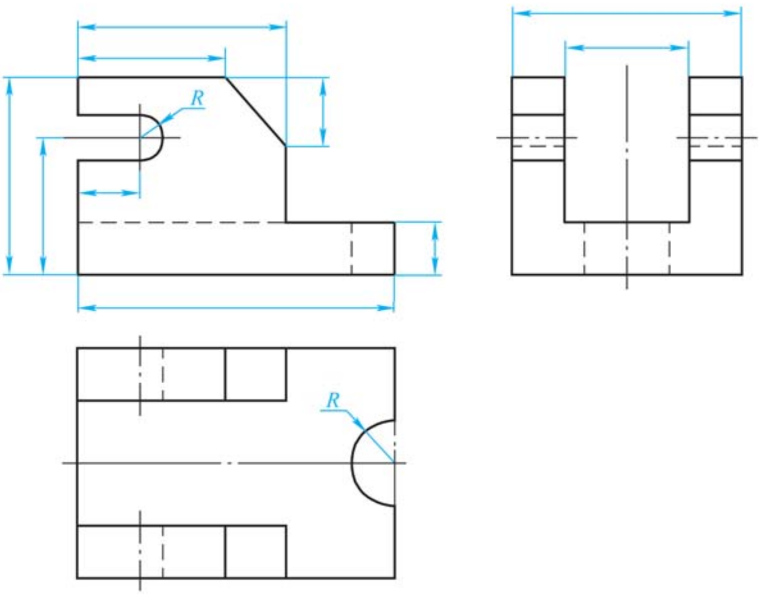
d) 误

例 3-15　分析组合体三视图尺寸标注的正误

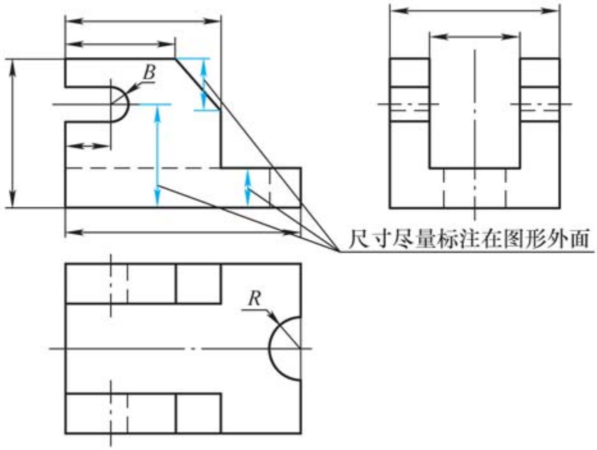
扫码看视频讲解



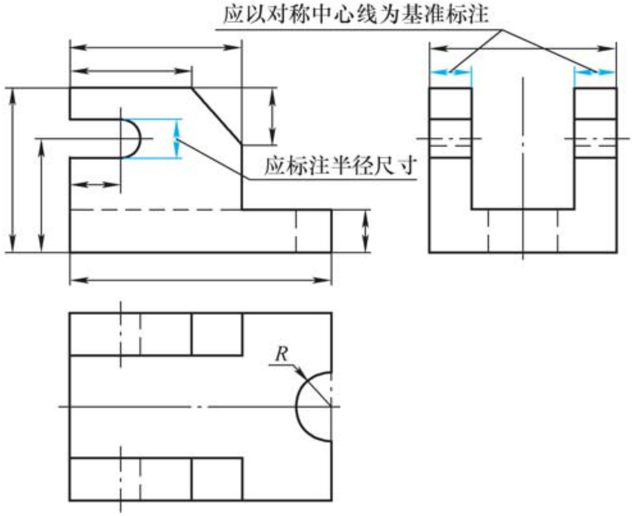
a) 立体图



b) 正

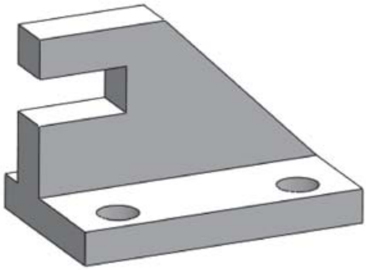


c) 误

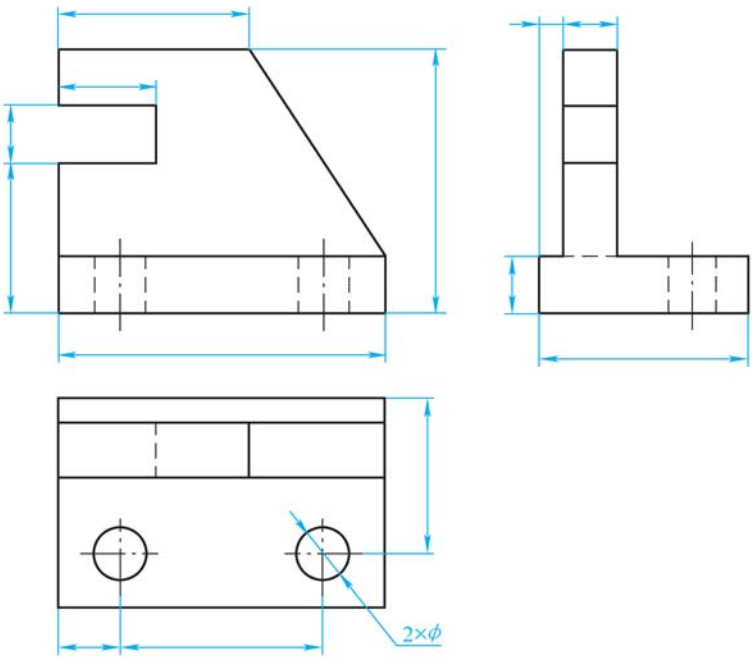


d) 误

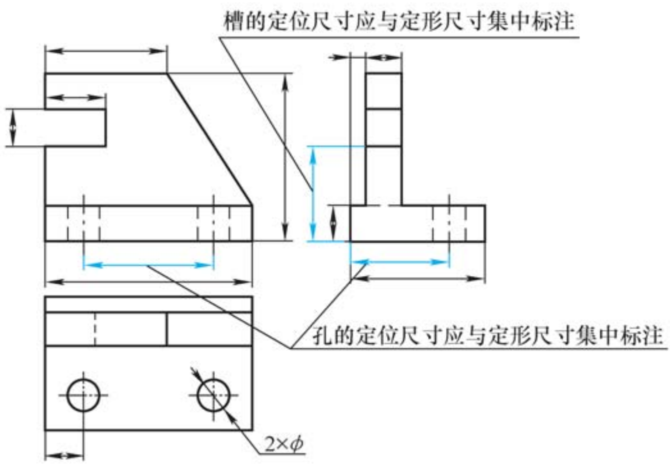
例 3-16 分析组合体三视图尺寸标注的正误



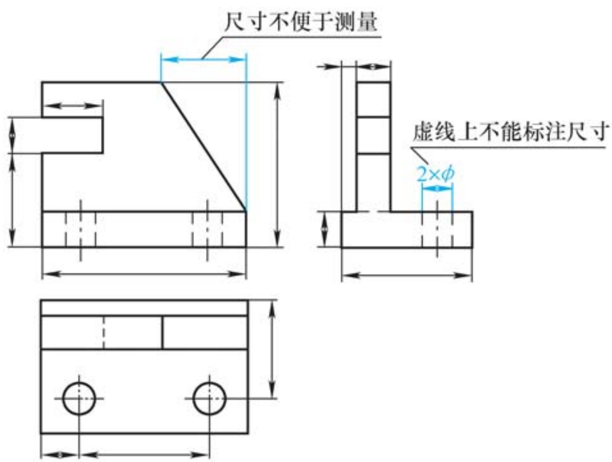
a) 立体图



b) 正


槽的定位尺寸应与定形尺寸集中标注
孔的定位尺寸应与定形尺寸集中标注
2×ϕ

c) 误

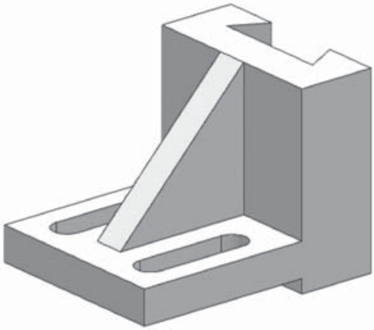

尺寸不便于测量
虚线上不能标注尺寸
2×ϕ

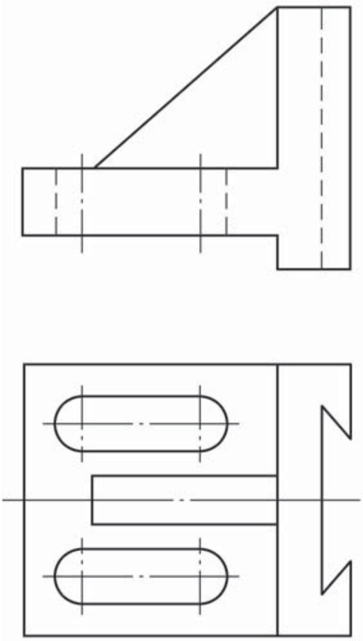
d) 误

练一练

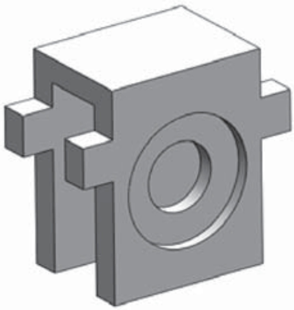
练习 3-1　根据主俯视图补画组合体左视图

扫码看视频讲解

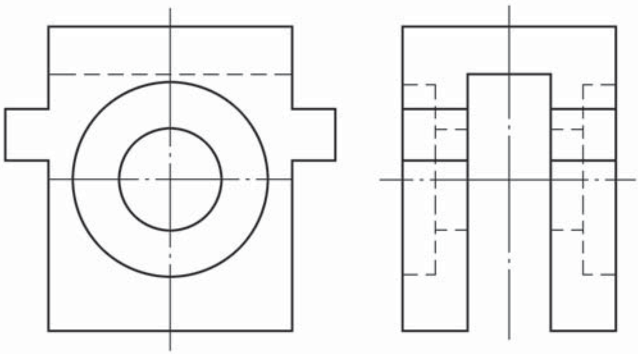


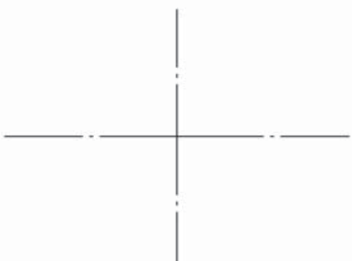


练习 3-2　根据主左视图补画组合体俯视图



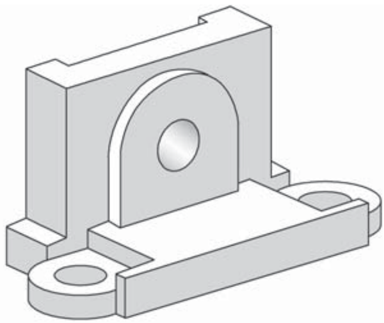
扫码看视频讲解

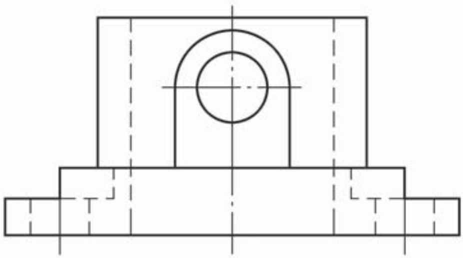


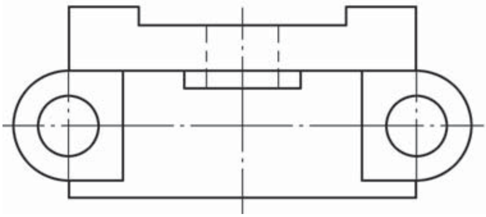


练习 3-3　根据主俯视图补画组合体左视图

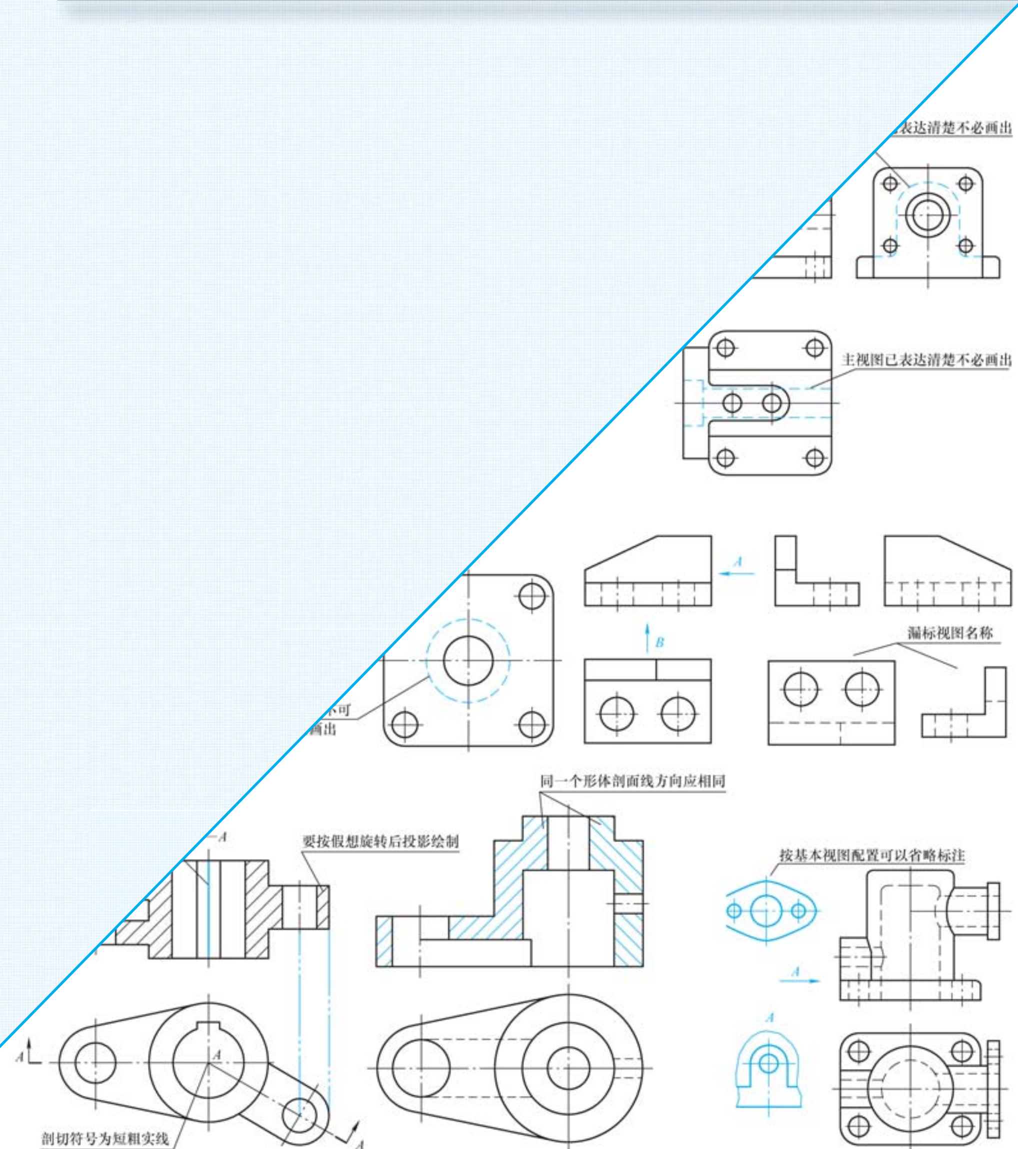
扫码看视频讲解





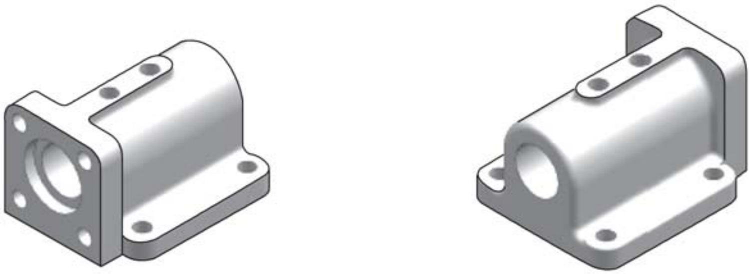


第 4 章 机件的表达方法

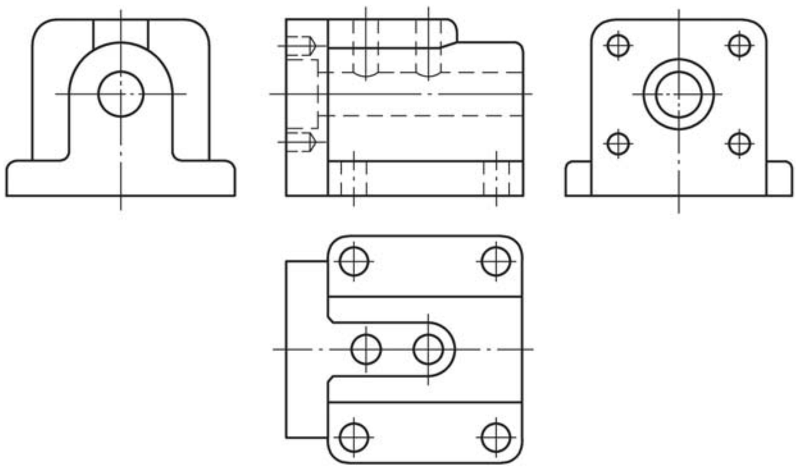

主视图已表达清楚不必画出
漏标视图名称
同一个形体剖面线方向应相同
要按假想旋转后投影绘制
按基本视图配置可以省略标注
剖切符号为短粗实线

4.1　基本视图和向视图

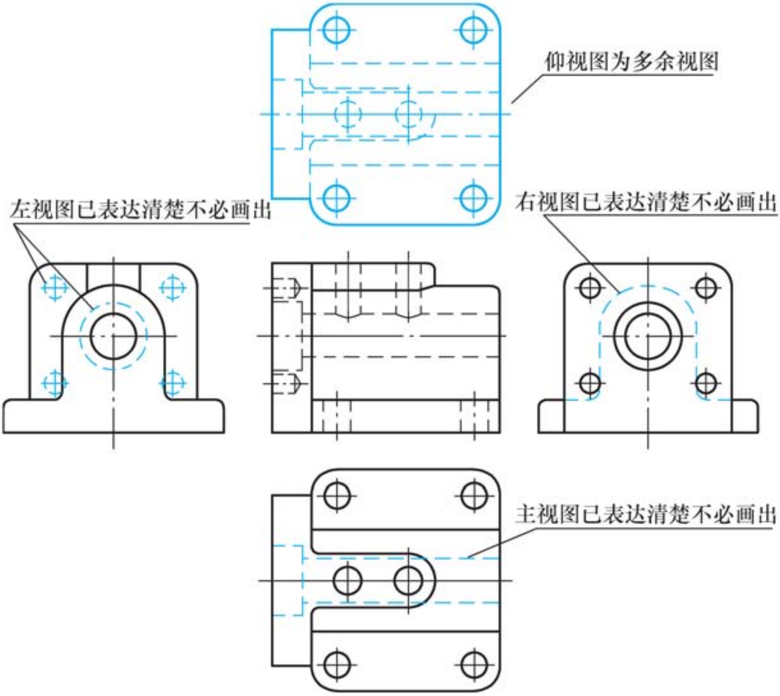
例 4-1　分析基本视图表达形体的正误



a) 立体图



b) 正



c) 误

扫码看视频讲解

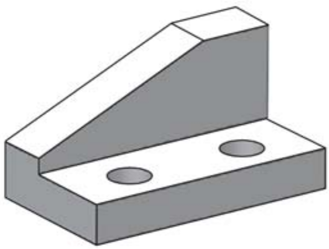
说明

1. 在实际应用中，基本视图主要表达零件的外部形状。应根据零件的结构特点、复杂程度选择必要的视图数量。

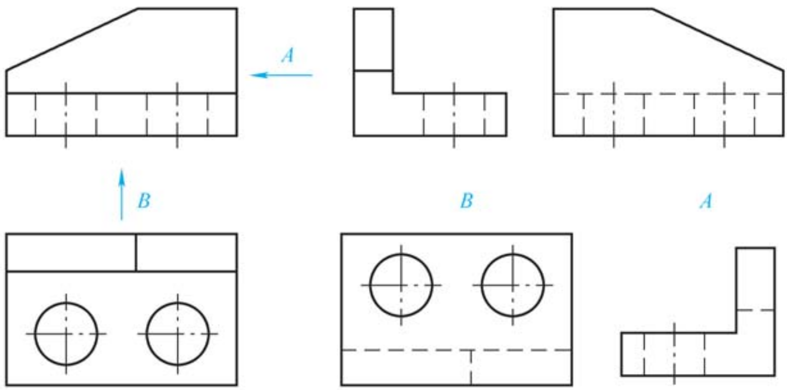
2. 对已经表达清楚的结构，虚线可以省略不画。

例 4-2　分析向视图表达形体标注的正误

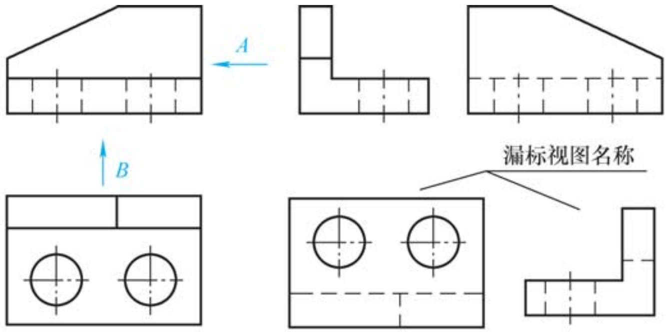
扫码看视频讲解



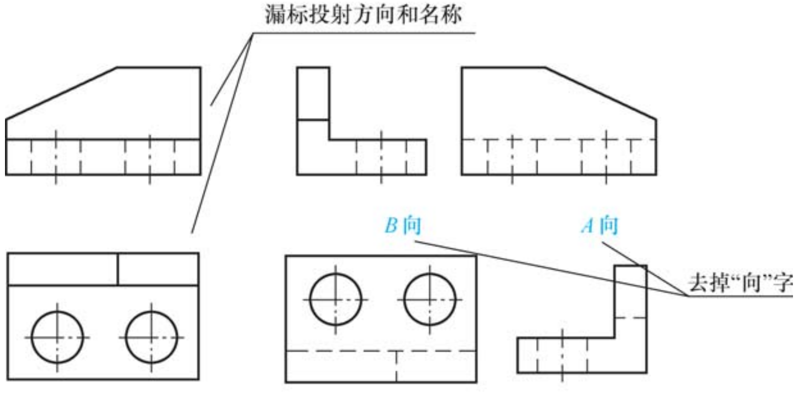
a) 立体图



b) 正



c) 误



d) 误

说明

1. 向视图与基本视图的区别是配置不同，向视图的配置是随意的所以必须标注视图名称。

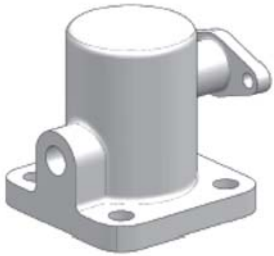
2. 表达投射方向的箭头尽量配置在主视图上，以便于所获得的视图与基本视图一致。

3. 向视图的视图名称用大写拉丁字母表示，不写"向"字。

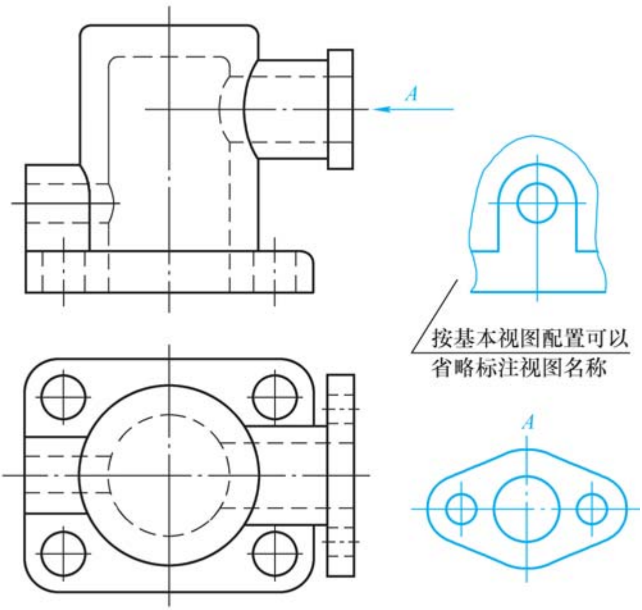
4.2 局部视图和斜视图

例 4-3 分析局部视图表达形体标注的正误

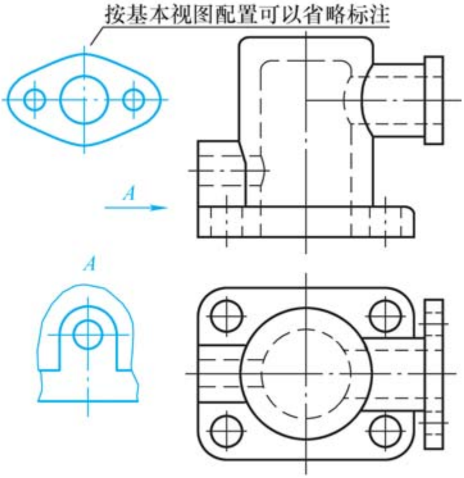




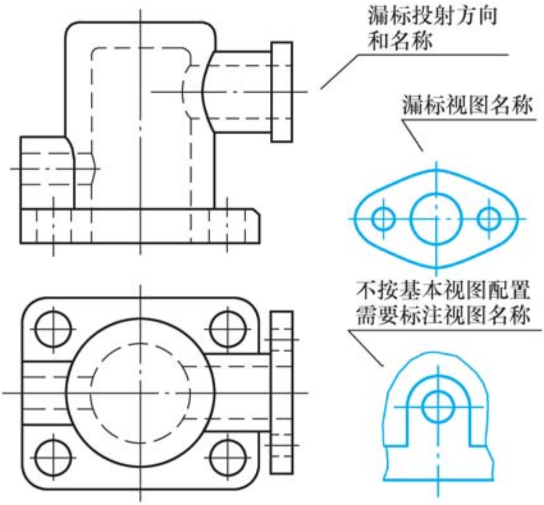
a) 立体图



b) 正



c) 正

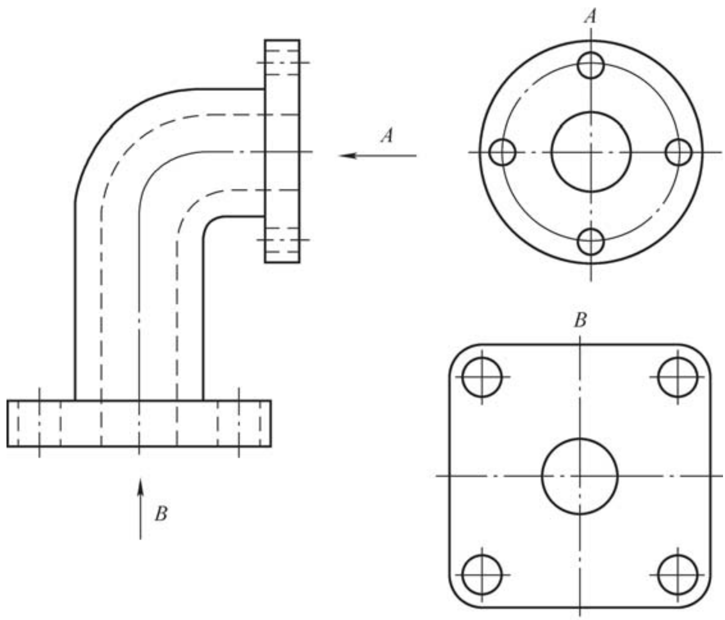


d) 误

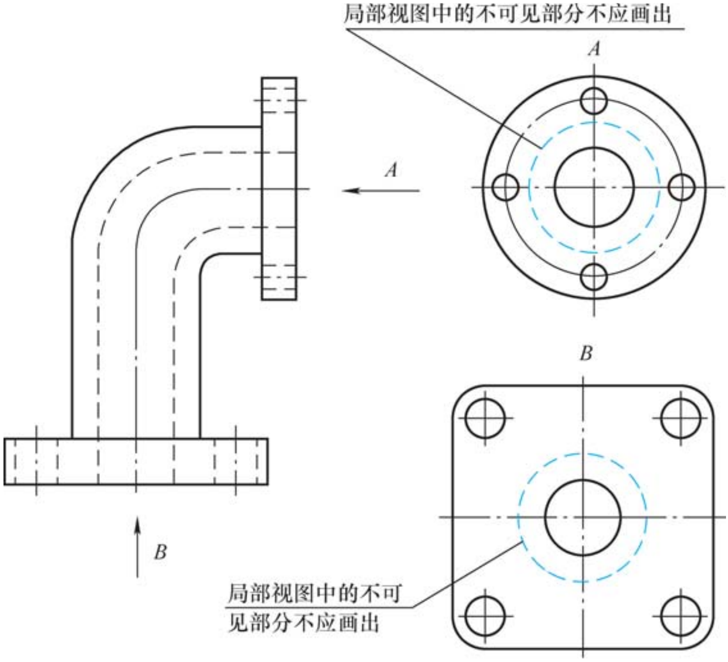
例 4-4　分析局部视图表达形体的正误



a) 立体图



b) 正



c) 误

说明

1. 局部视图与基本视图的区别是表达的范围多少不同。

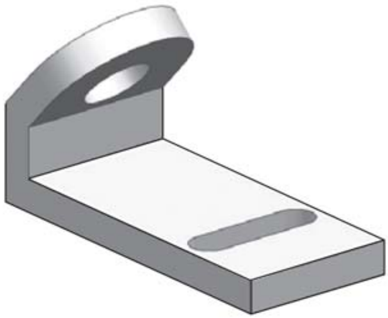
2. 局部视图按基本视图配置可以省略标注投射方向和视图名称，否则应标注。

3. 局部视图一般用波浪线表示断裂部分的边界。

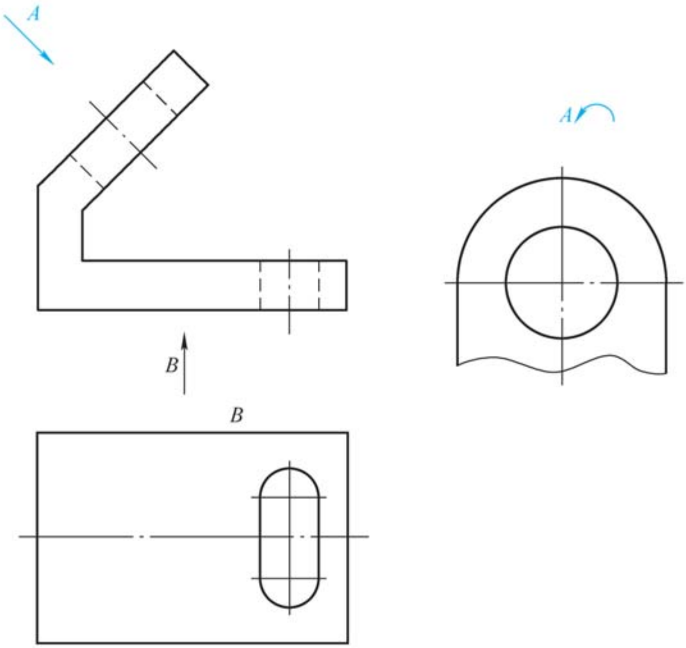
4. 当局部结构是完整而封闭的图形时，可以不画波浪线。

例 4-5　分析斜视图表达形体标注的正误

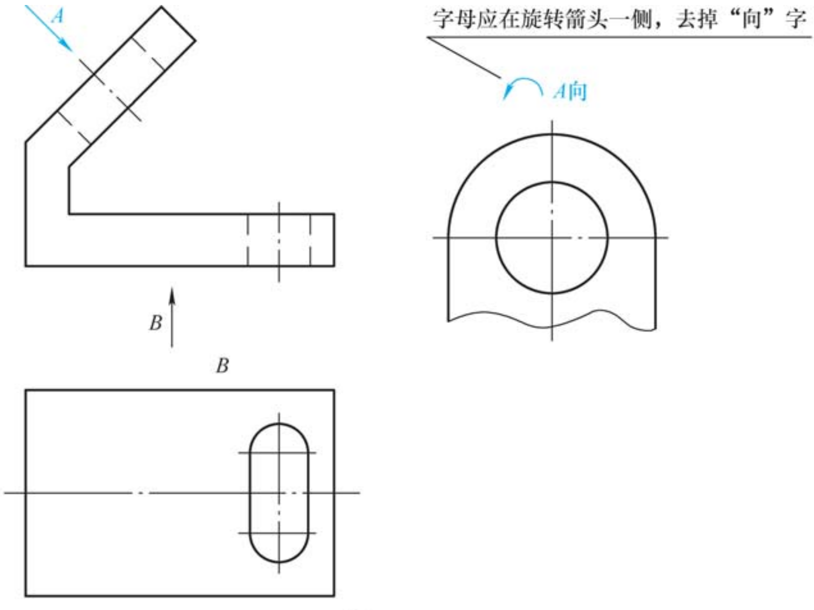
扫码看视频讲解



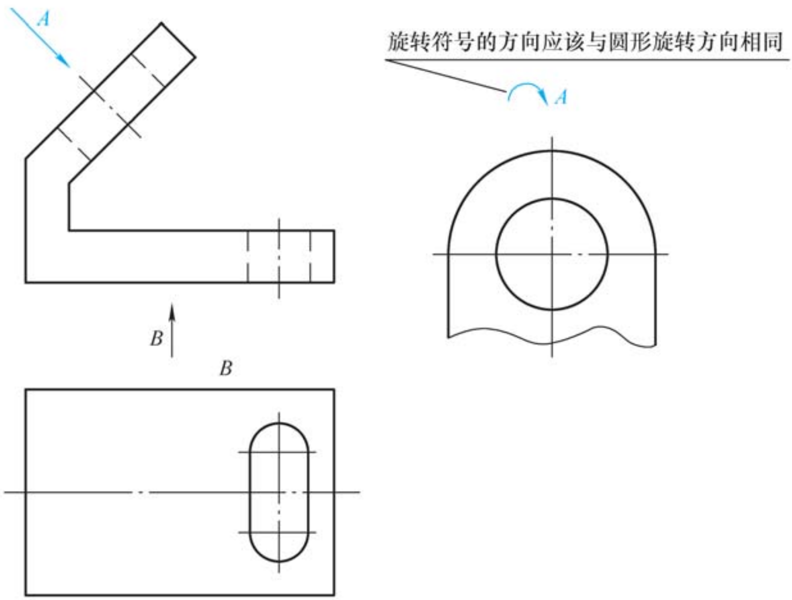
a) 立体图



b) 正



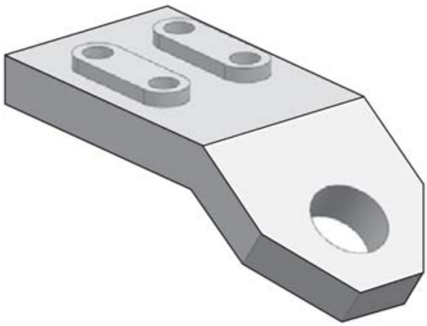
c) 误



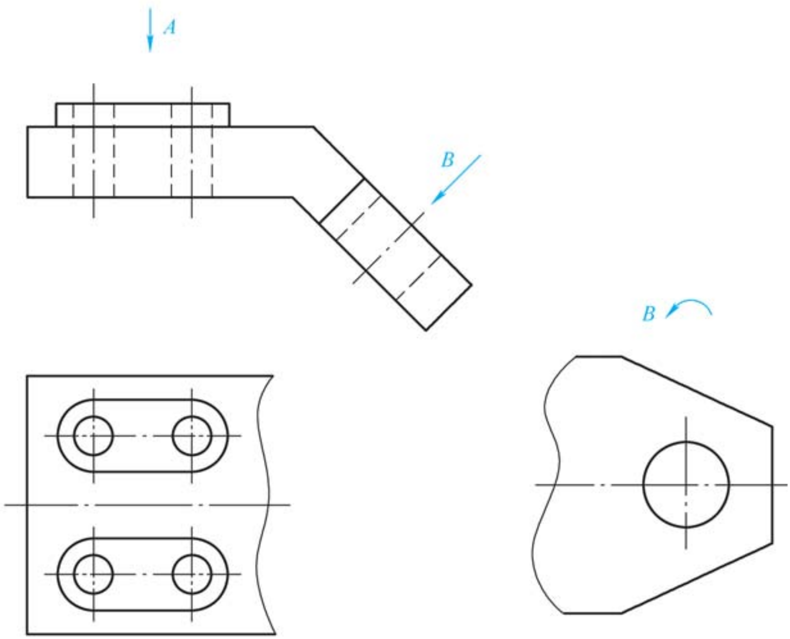
d) 误

例 4-6　分析斜视图表达形体标注的正误

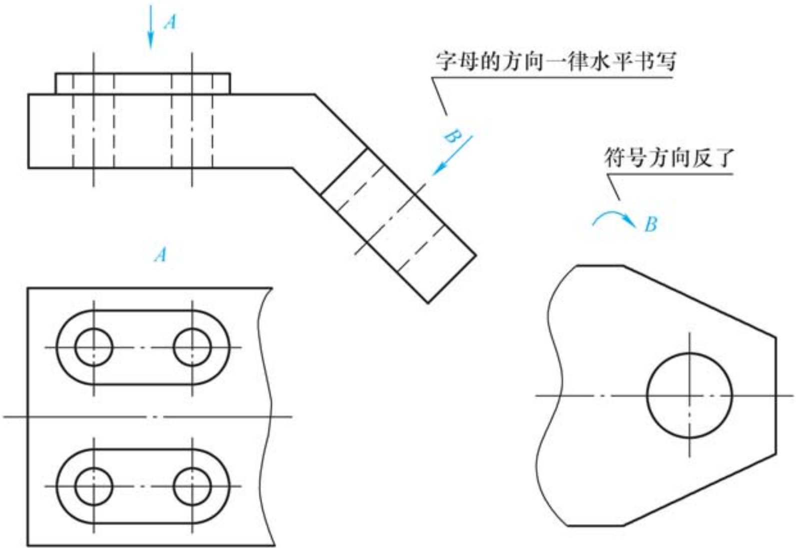
扫码看视频讲解



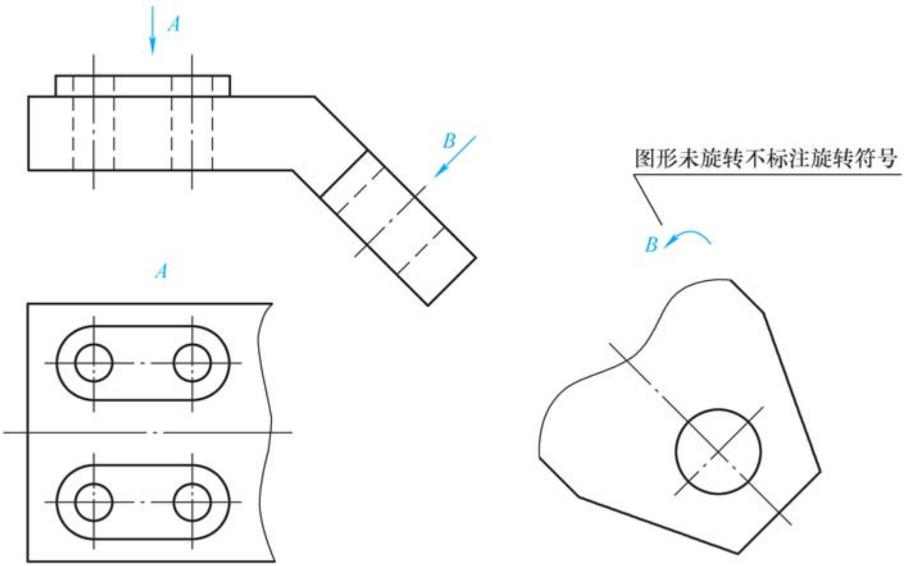
a) 立体图



b) 正

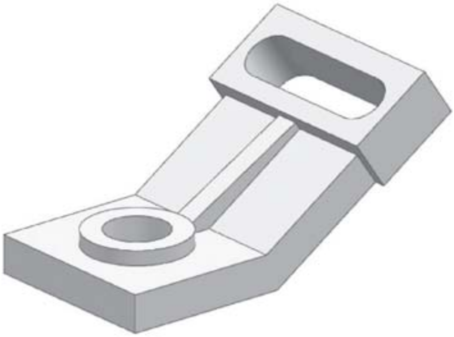


c) ㊣误

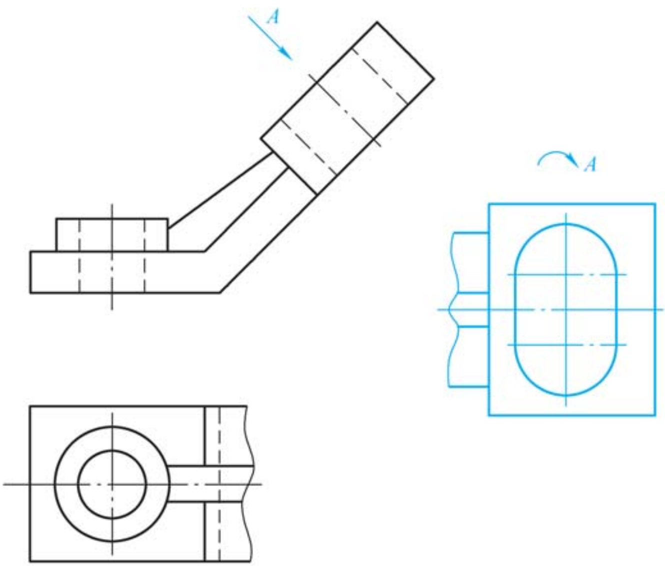


d) ㊣误

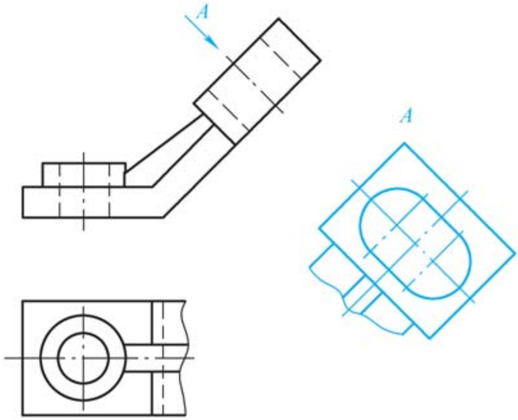
例 4-7　分析斜视图表达形体的正误



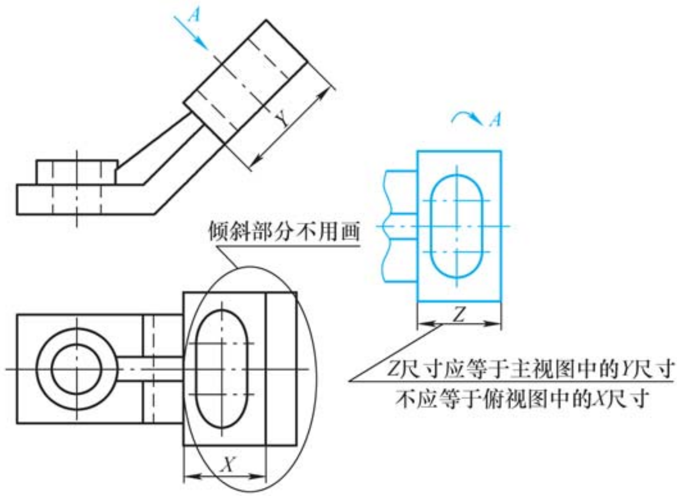
a) 立体图



b) 正



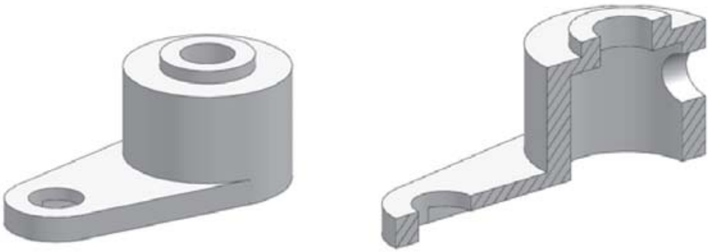
c) 正



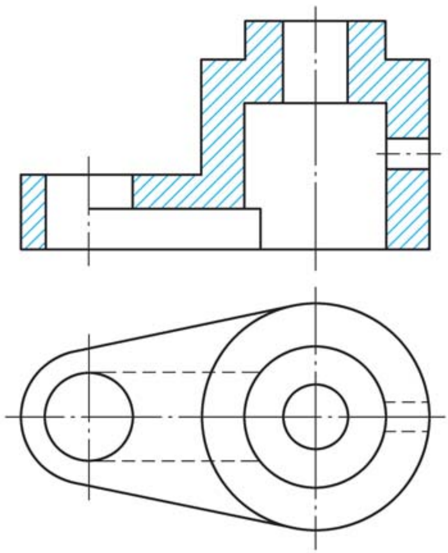
d) 误

4.3　剖视图

例 4-8　分析剖视图中剖面符号的正误

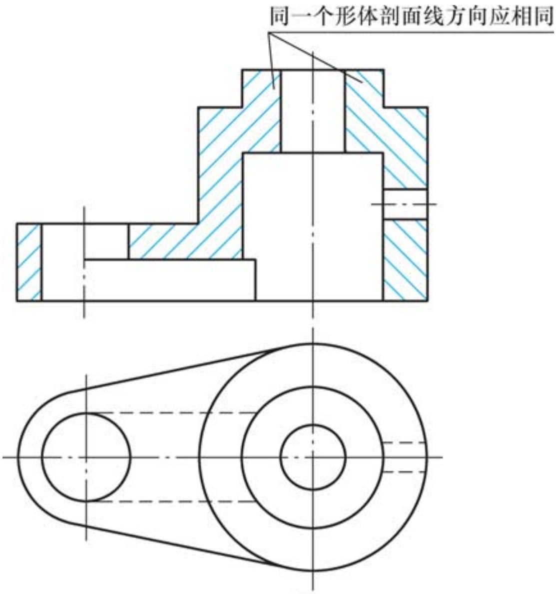


a) 立体图

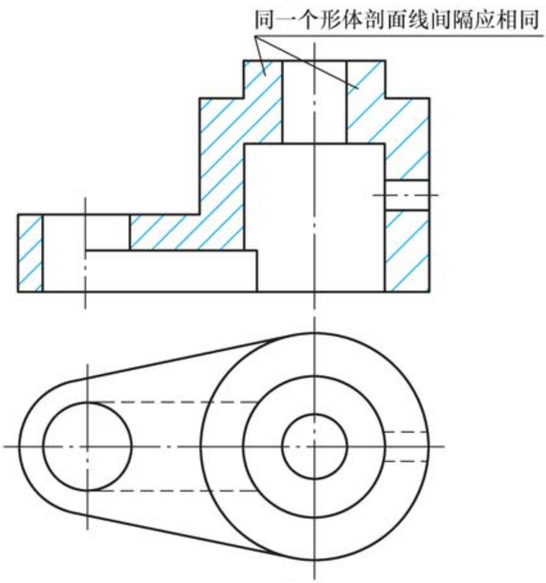


b) 正

扫码看视频讲解

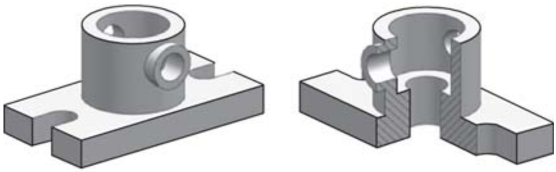


c) 误

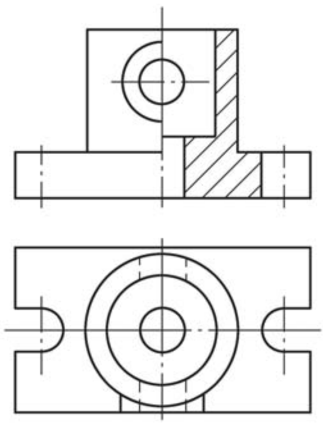


d) 误

例 4-9　分析半剖视图表达的正误



a) 立体图



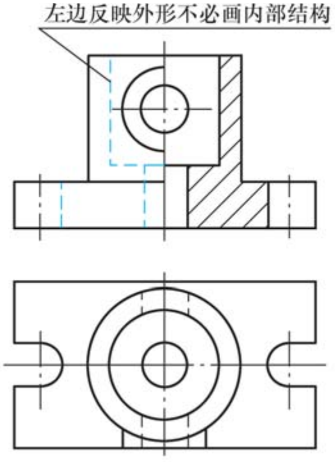
b) 正

说明

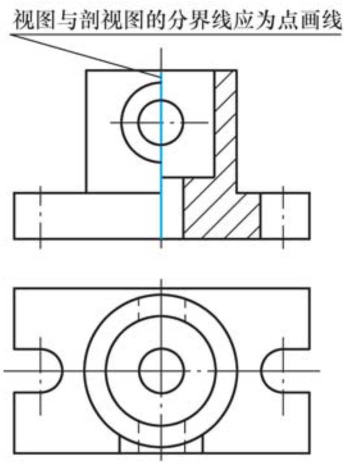
1. 形体必须是对称的才能采用半剖视图。

2. 半个视图与半个剖视图的分界线是单点画线。

3. 画成视图的一半表示外部结构，故表示内部的虚线不必画出。



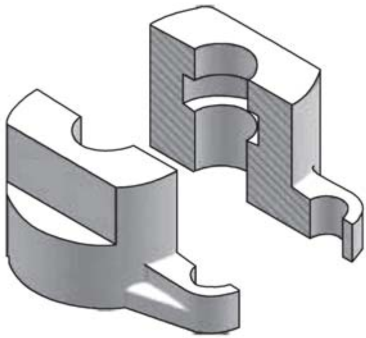
c) 误



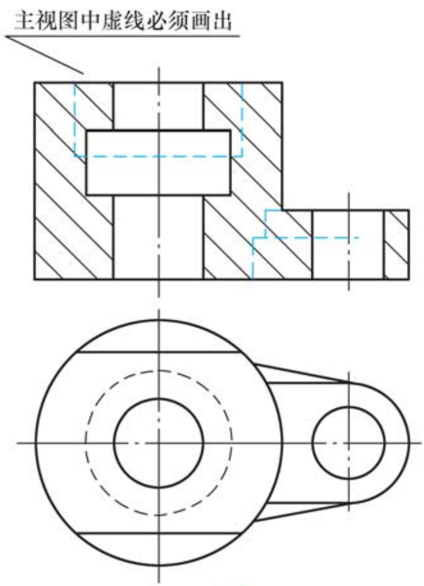
d) 误

扫码看视频讲解

例 4-10　分析剖视图表达的正误



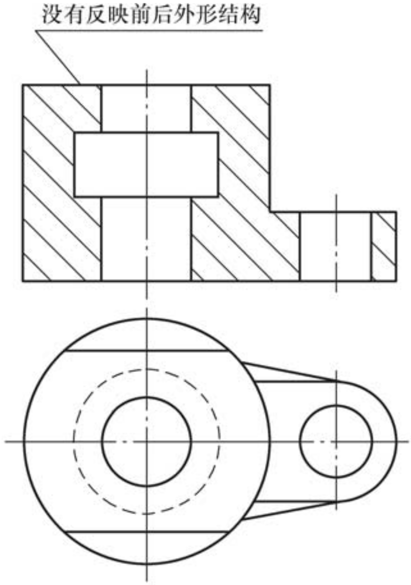
a) 立体图



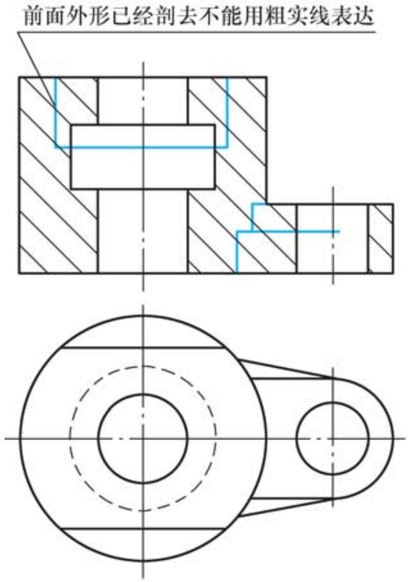
b) 正

说明

在剖视图中一般不画虚线，当虚线所表示的结构表达不清楚时，虚线必须画出。



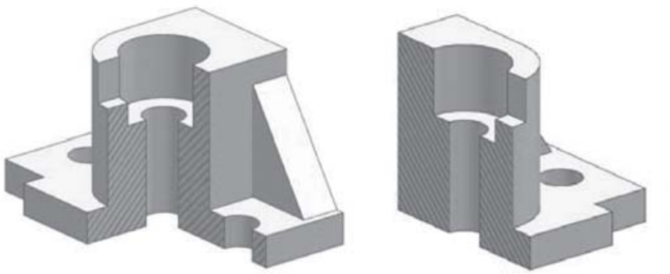
c) 误



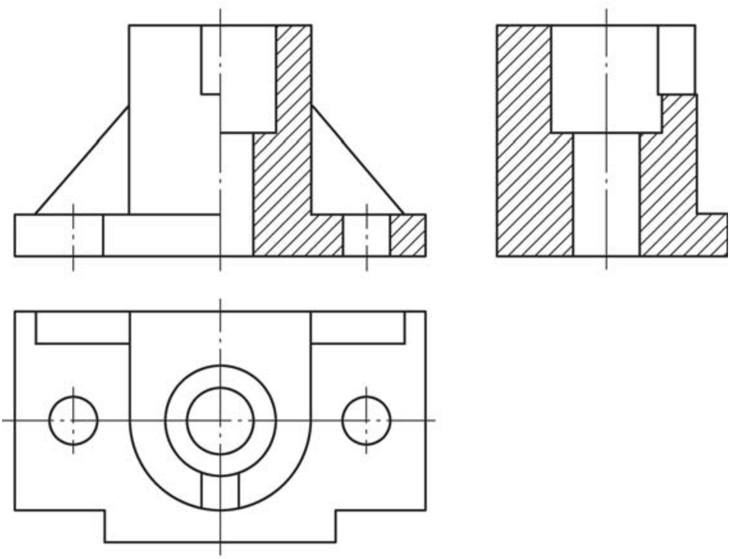
d) 误

扫码看视频讲解

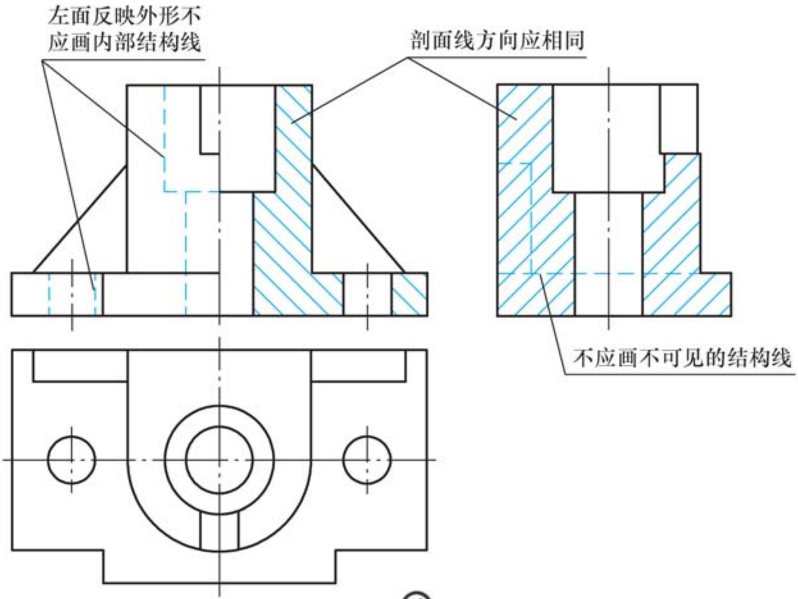
例 4-11　分析剖视图表达的正误



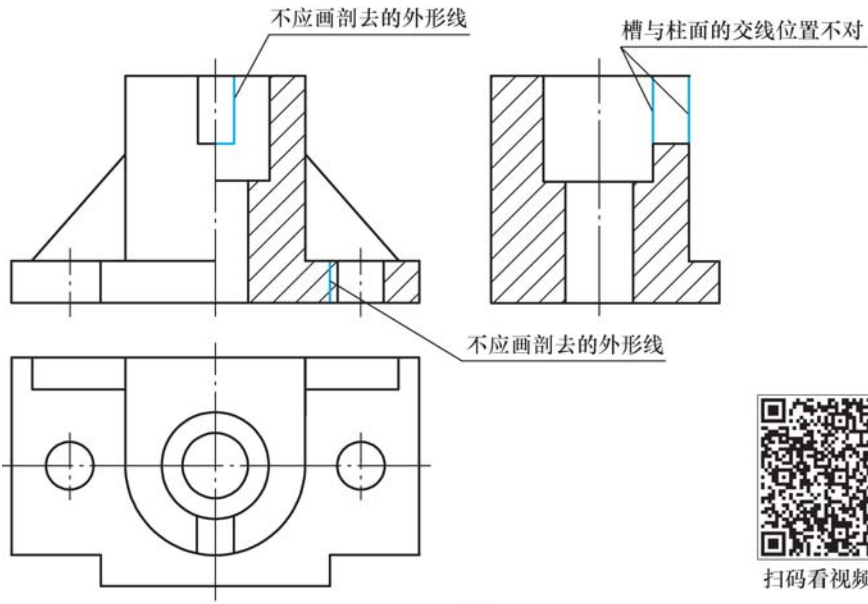
a) 立体图



b) 正



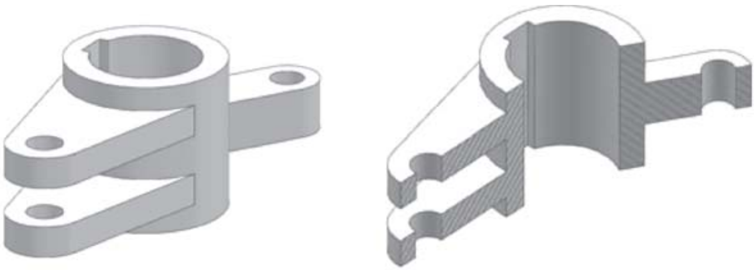
c) 误



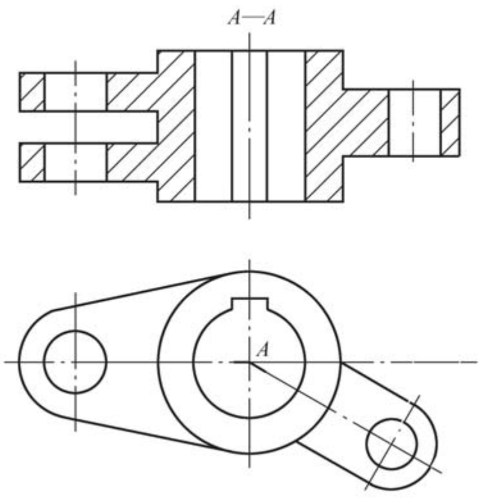
d) 误

扫码看视频讲解

例 4-12　分析剖视图表达的正误

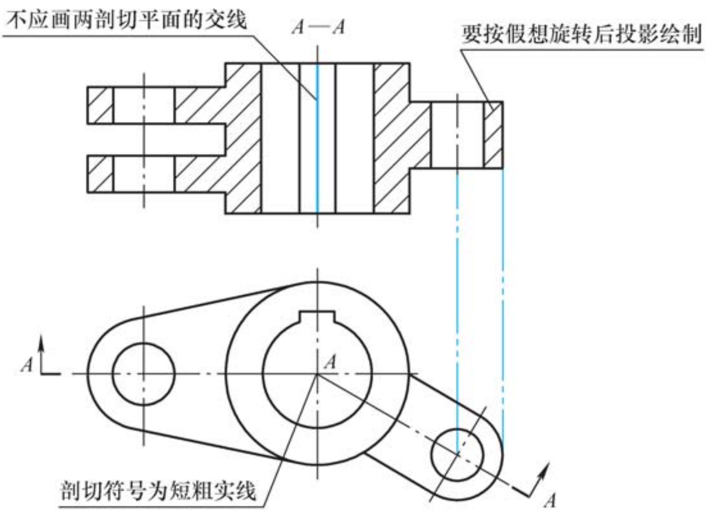


a) 立体图

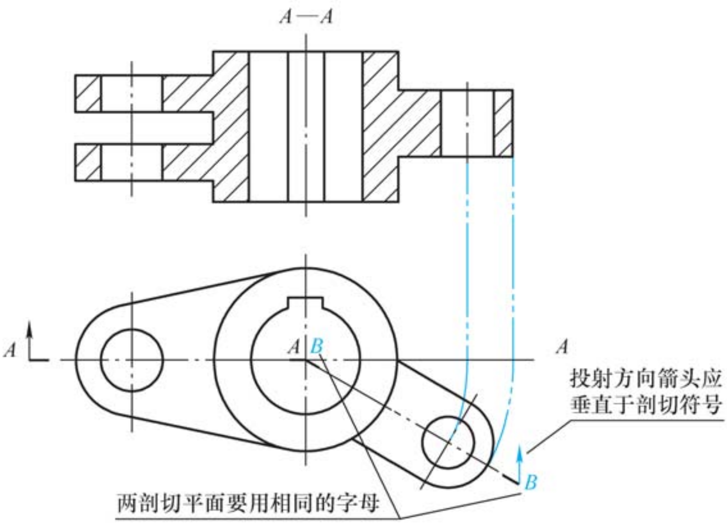


b) 正

扫码看视频讲解

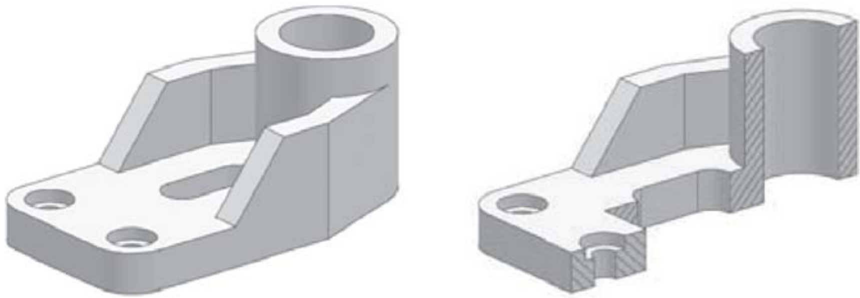

不应画两剖切平面的交线
A—A
要按假想旋转后投影绘制
A
A
A
剖切符号为短粗实线

c) 误

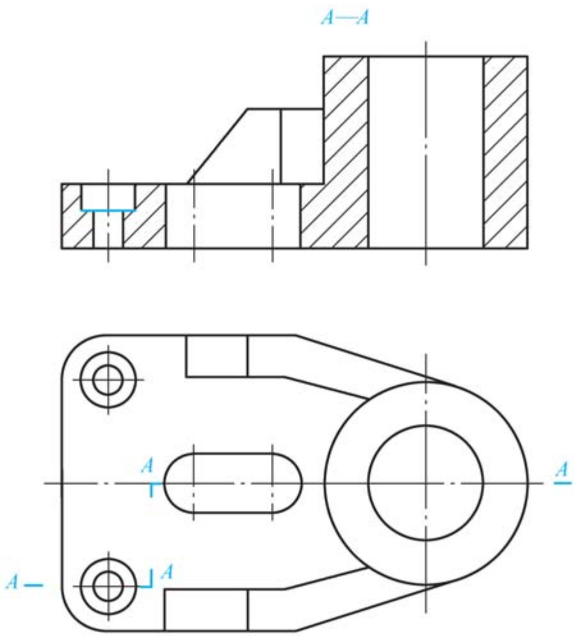

A—A
A
A B
A
投射方向箭头应
垂直于剖切符号
B
两剖切平面要用相同的字母

d) 误

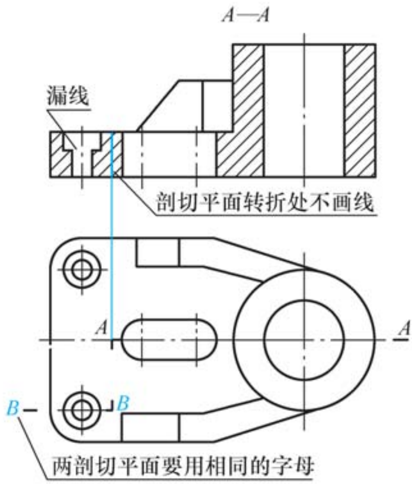
例 4-13　分析剖视图表达的正误



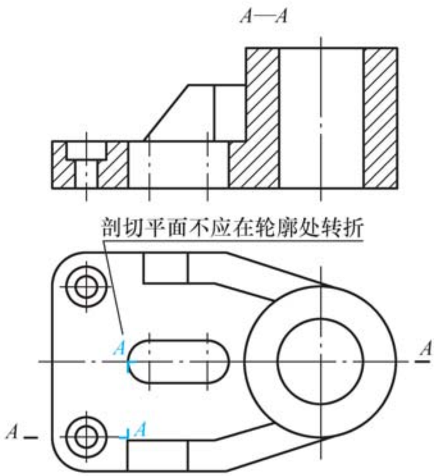
a) 立体图



b) 正



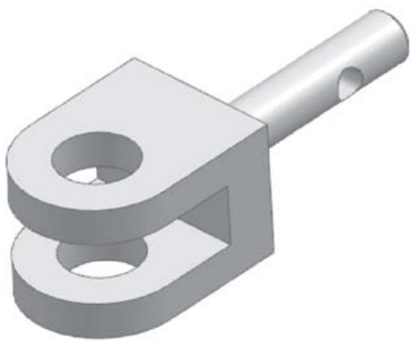
c) 误



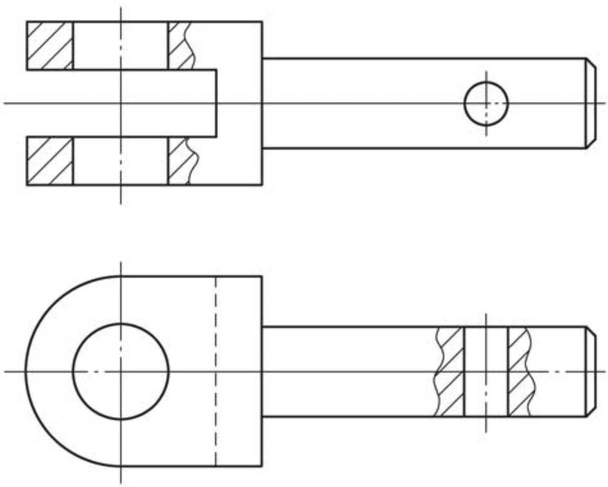
d) 误

扫码看视频讲解

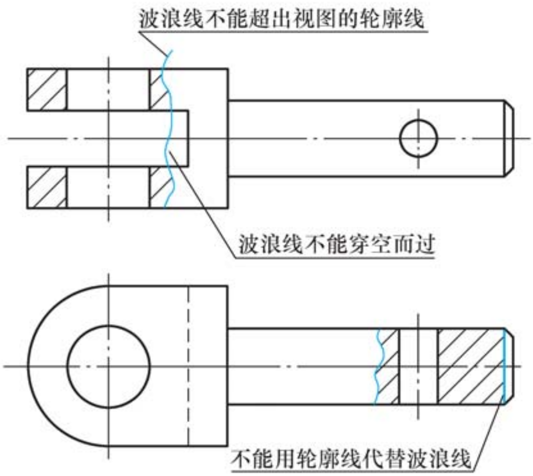
例 4-14　分析剖视图表达的正误



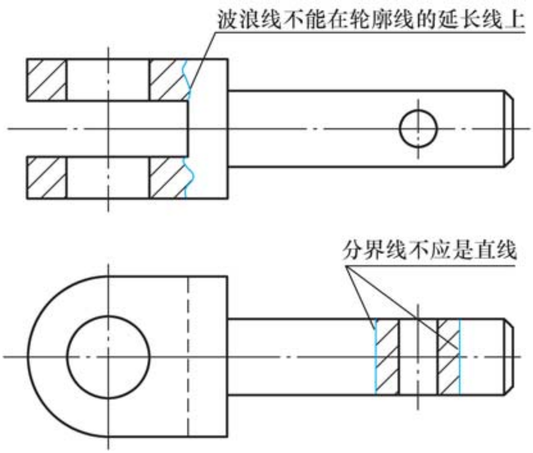
a) 立体图



b) 正

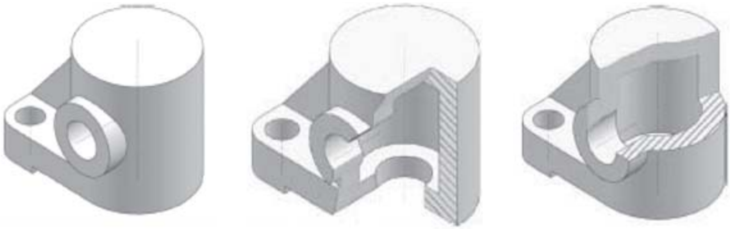

波浪线不能超出视图的轮廓线
波浪线不能穿空而过
不能用轮廓线代替波浪线

c) 误

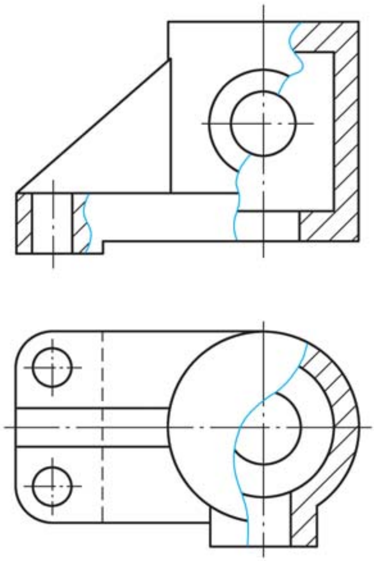

波浪线不能在轮廓线的延长线上
分界线不应是直线

d) 误

例 4-15　分析剖视图表达的正误

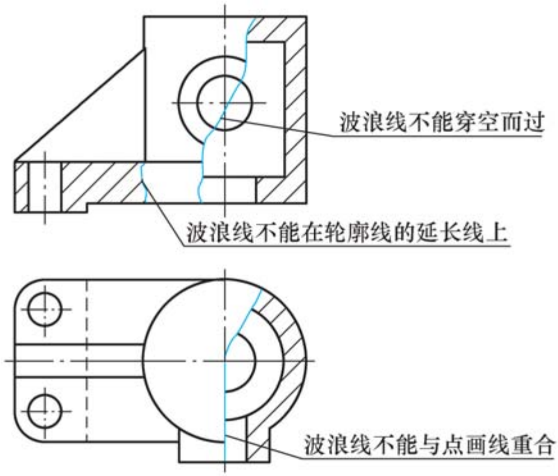


a) 立体图

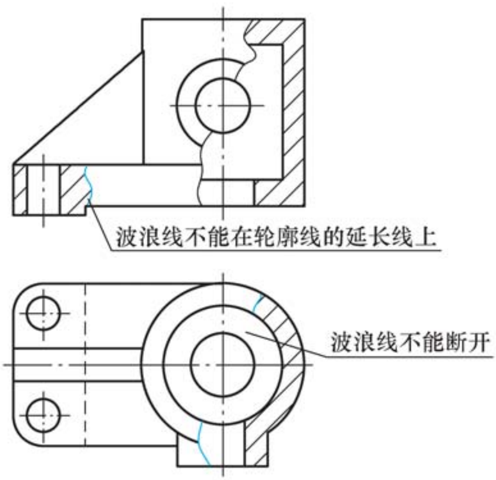


b) 正

扫码看视频讲解

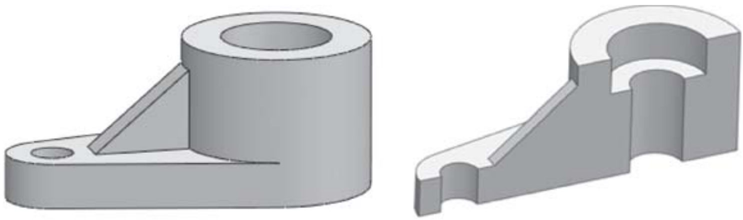

波浪线不能穿空而过
波浪线不能在轮廓线的延长线上
波浪线不能与点画线重合

c) 误

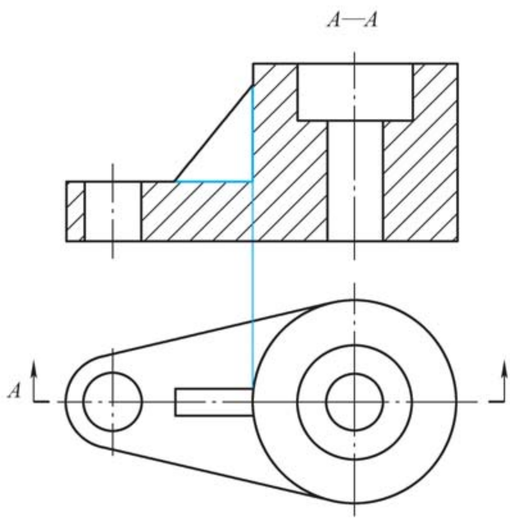

波浪线不能在轮廓线的延长线上
波浪线不能断开

d) 误

例 4-16　分析剖视图中肋板表达的正误

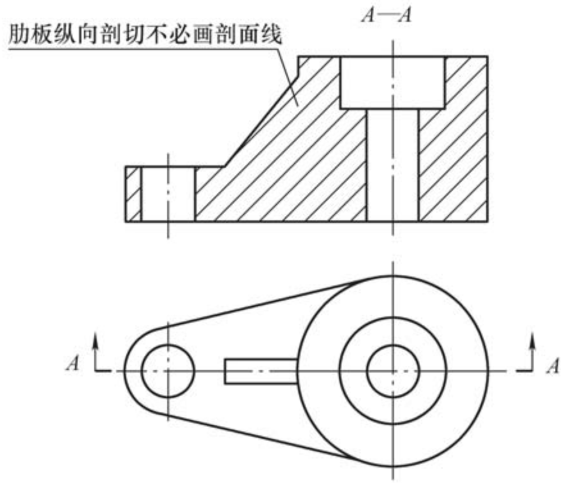


a) 立体图

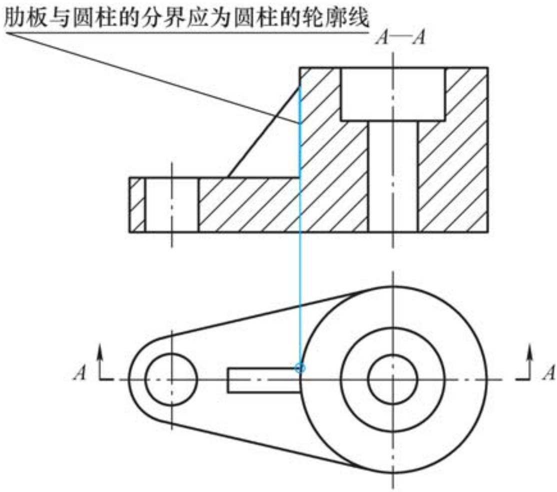


b) 正

扫码看视频讲解



c) 误

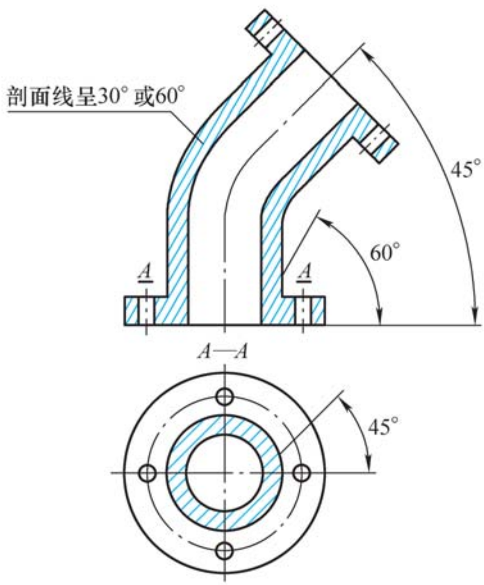


d) 误

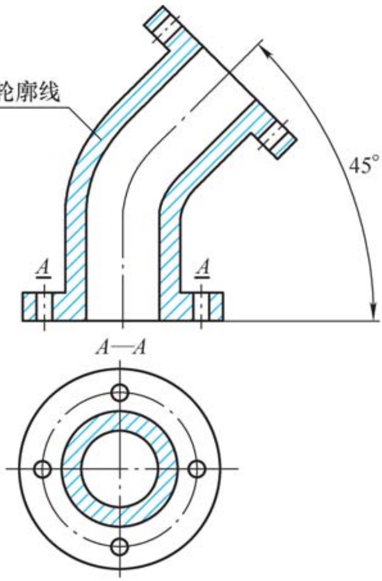
例 4-17　分析剖视图中剖面线的正误



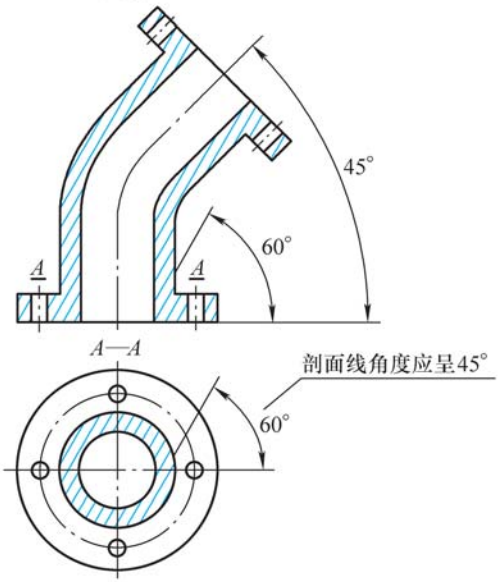
a) 立体图



b) 正



c) 误



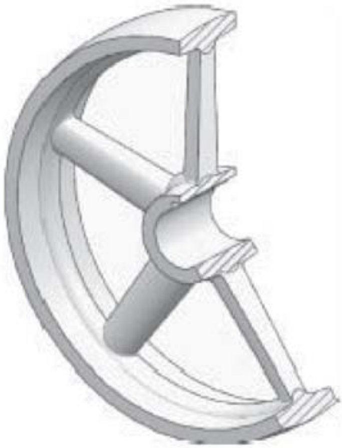
d) 误

扫码看视频讲解

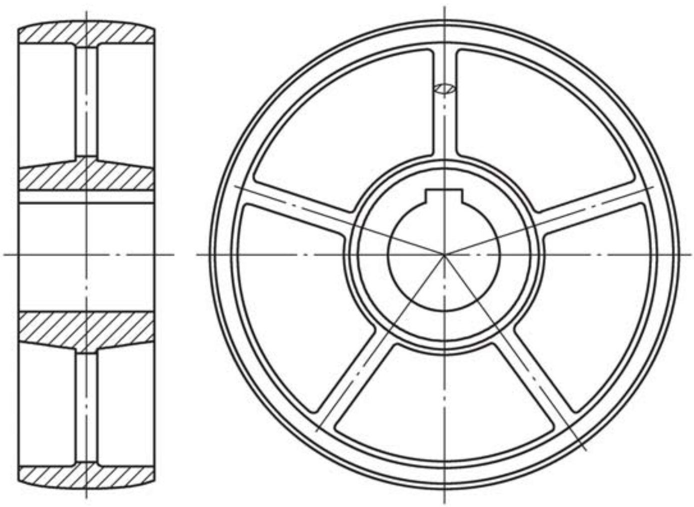
例 4-18　分析剖视图中轮幅表达的正误



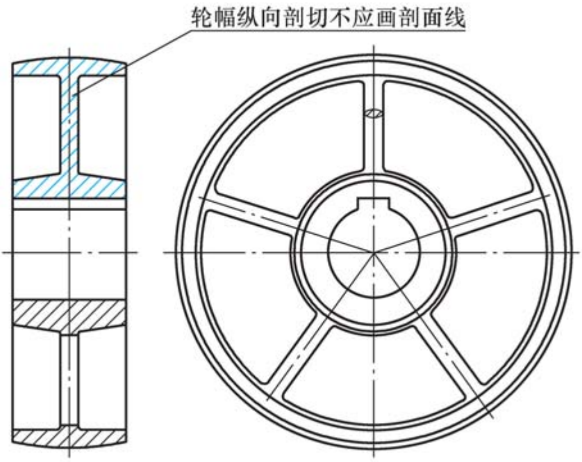
扫码看视频讲解



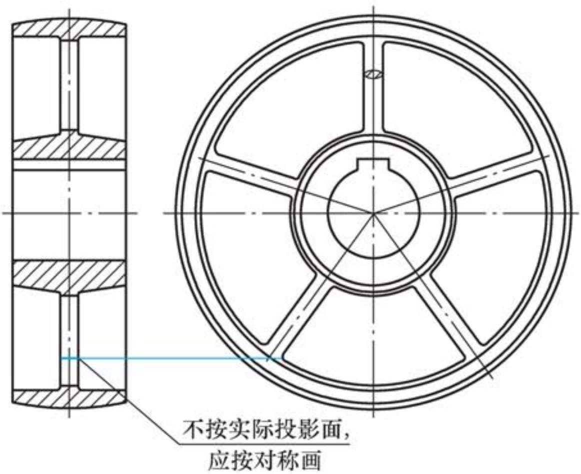
a) 立体图



b) 正



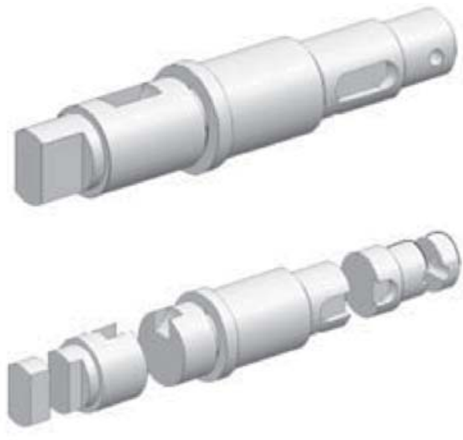
c) 误



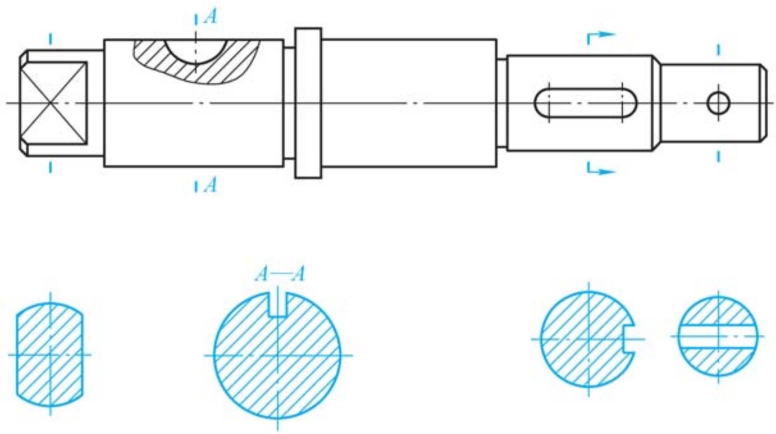
d) 误

4.4 断面图

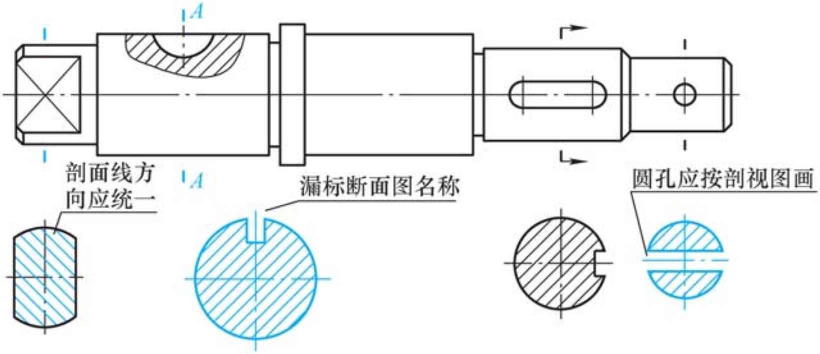
例 4-19 分析移出断面图表达的正误



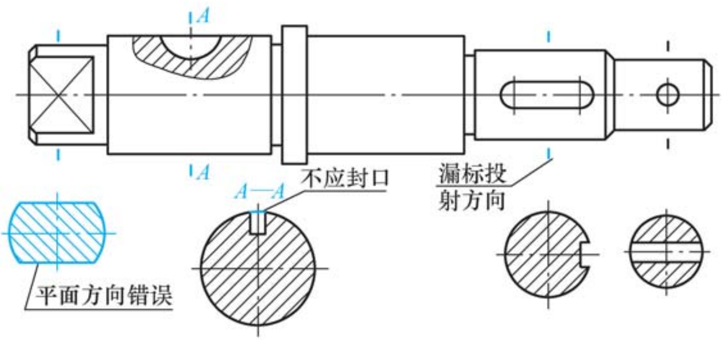
a) 立体图



b) 正



c) 误



d) 误

扫码看视频讲解

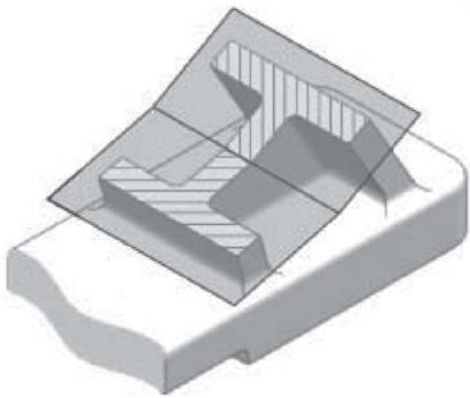
说明

1. 移出断面图的图形画在视图的外面，轮廓线用粗实线绘制。

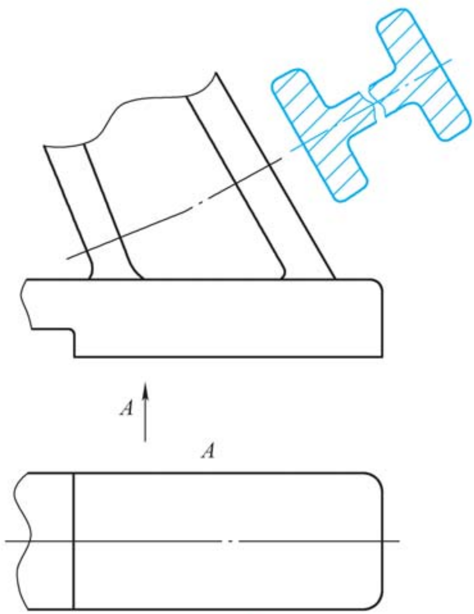
2. 断面图可以配置在剖切平面的延长线上，也可以配置在其他合适的位置。

例 4-20　分析移出断面图表达的正误

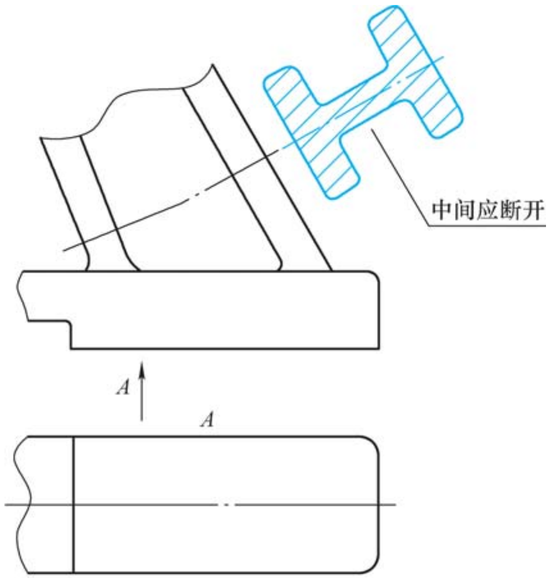
扫码看视频讲解



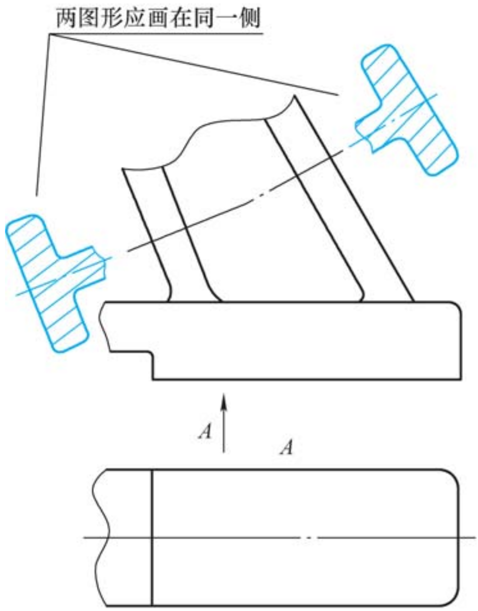
a) 立体图



b) 正

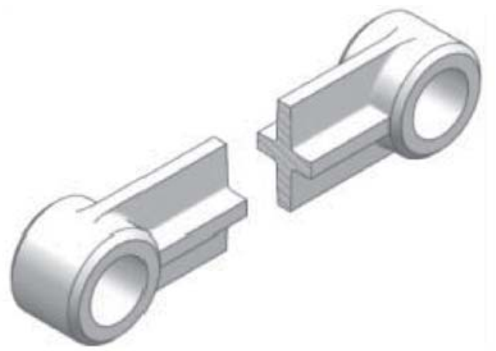


c) ㊟误

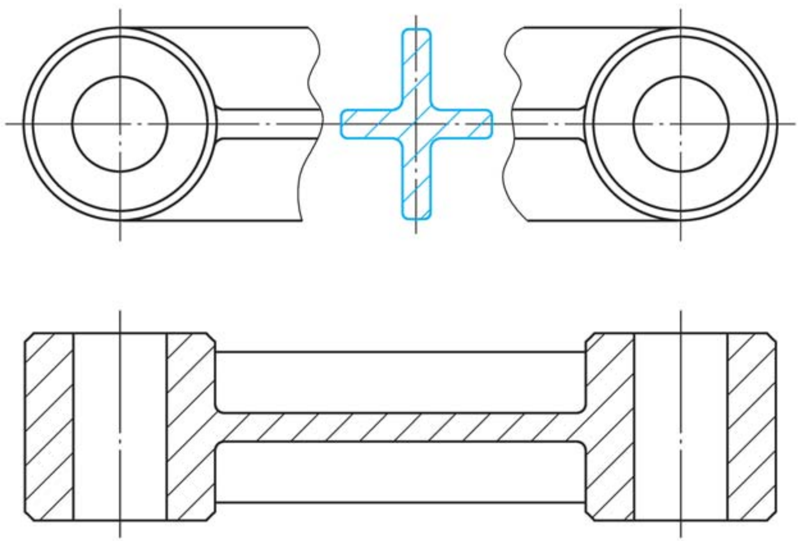


d) ㊟误

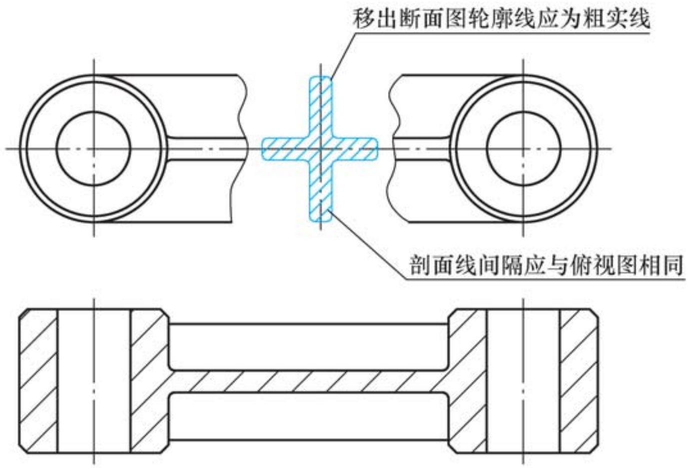
例 4-21　分析移出断面图表达的正误



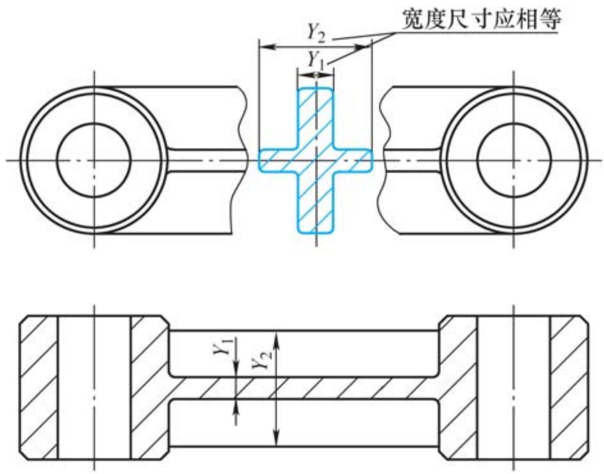
a) 立体图



b) 正

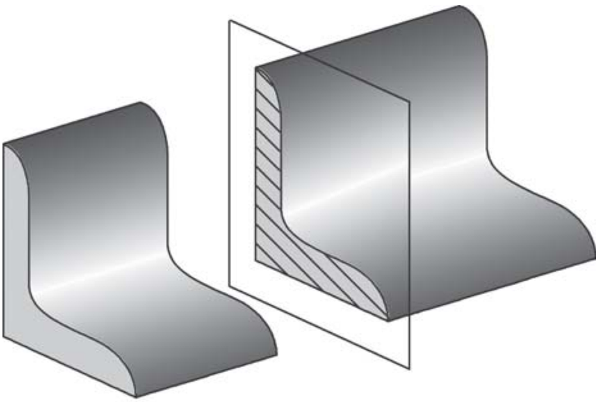


c) ㊝

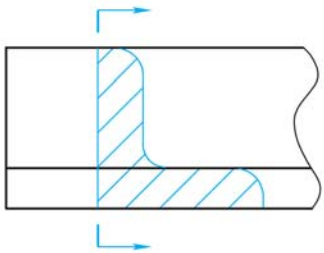


d) ㊝

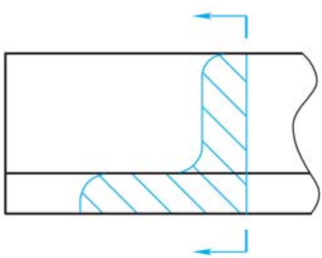
例 4-22　分析重合断面图表达的正误



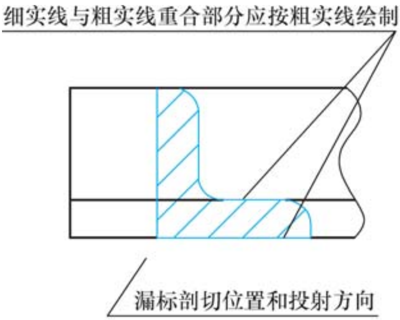
a) 立体图



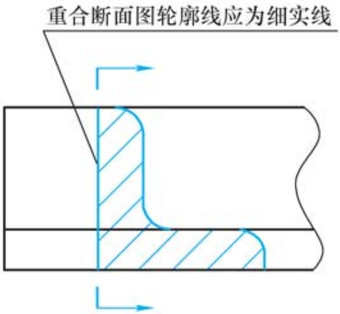
或



b) 正



c) 误



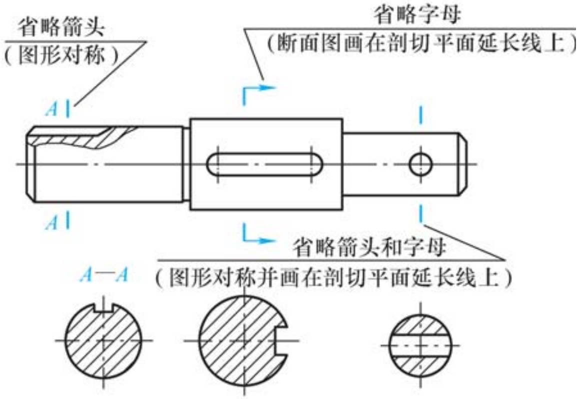
d) 误

扫码看视频讲解

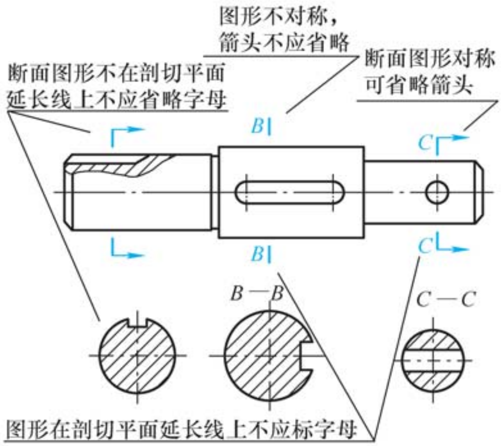
说明

1. 重合断面图的图形应画在视图之内。
2. 重合断面图应画在剖切位置处。
3. 重合断面图的轮廓线用细实线绘制。
4. 当断面图与视图的轮廓线重叠时，视图的轮廓要完整画出不得间断。

例 4-23　分析移出断面图标注方法的正误



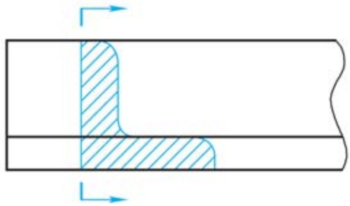
a) 正



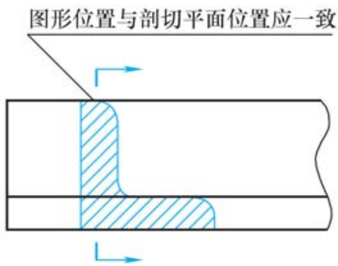
b) 误

扫码看视频讲解

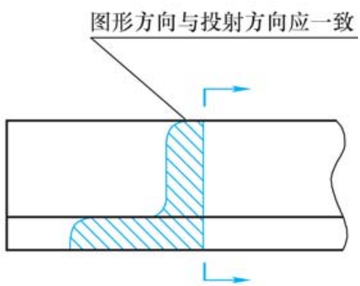
例 4-24　分析重合断面图标注方法的正误



a) 正



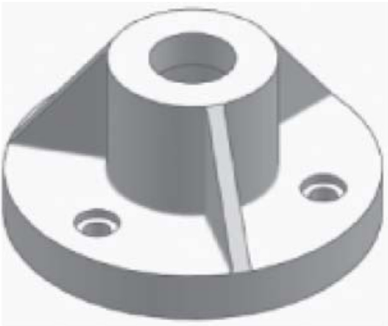
b) 误



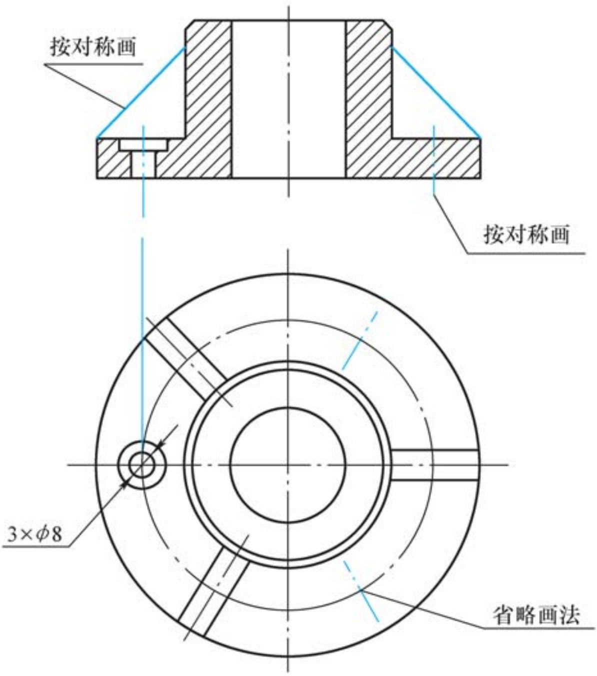
c) 误

4.5 简化画法

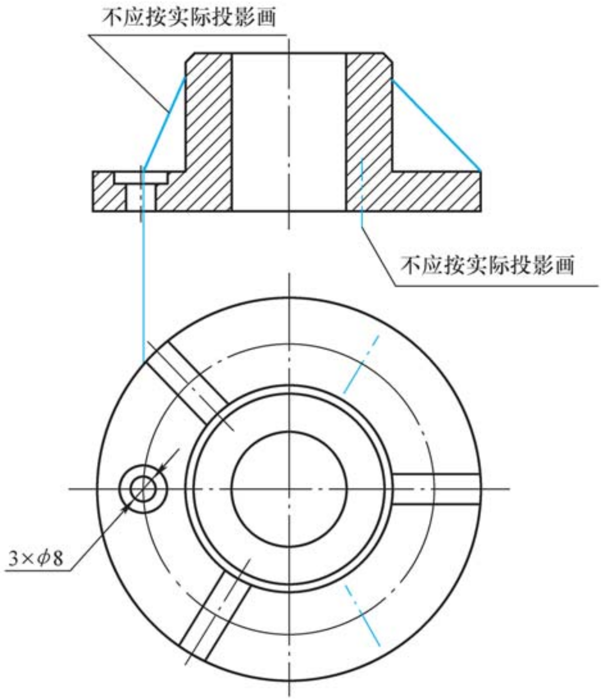
例 4-25 分析零件表达的正误



a) 立体图



b) 正



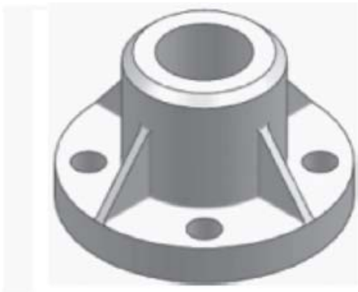
c) 误

说明

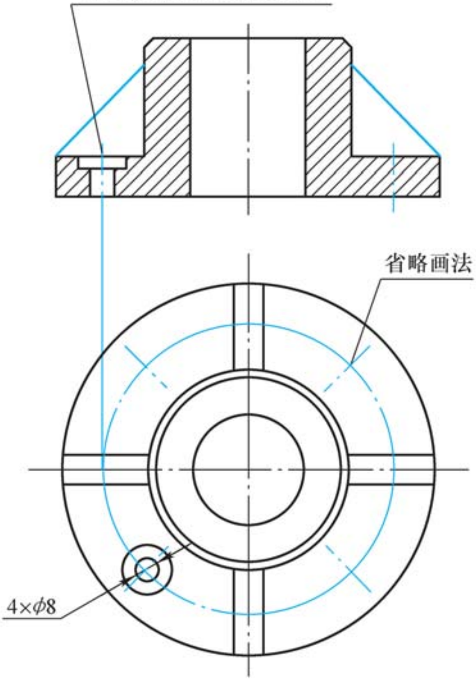
1. 零件回转面上均匀分布的肋板和幅板投影不对称时，应按对称画。

2. 零件回转面上均匀分布的孔投影不对称时，孔轴线应按对称画。

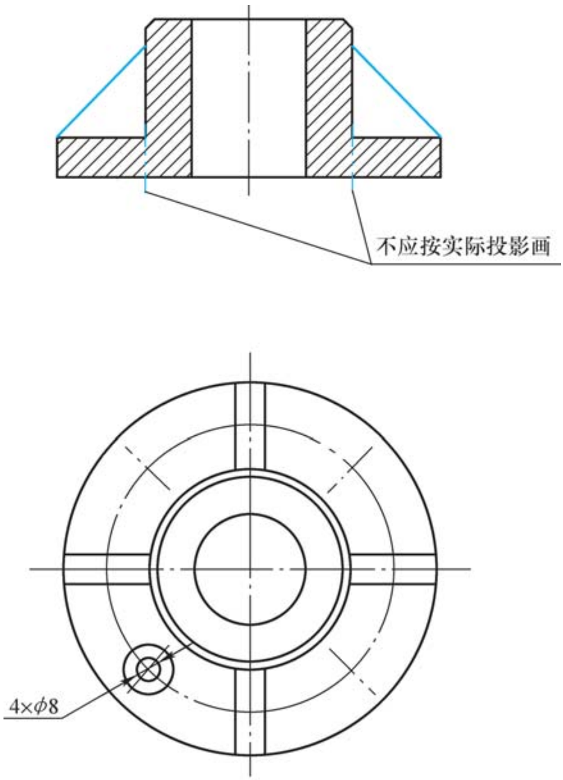
例 4-26　分析零件表达的正误



a) 立体图



b) 正



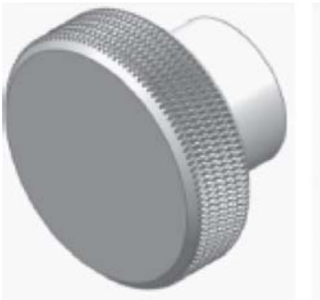
c) 误

说明

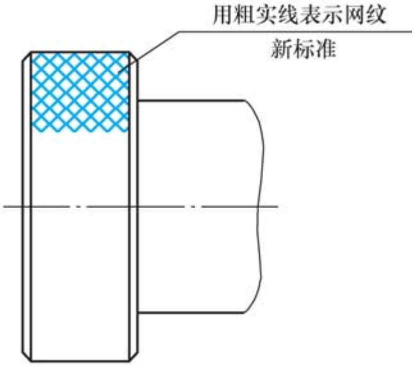
1. 当孔的结构不处在剖切平面上时，可以假想将这些结构旋转到剖切平面上画。

2. 同一平面上相同的孔可以只画一个，其余孔用点画线表示孔的中心位置。

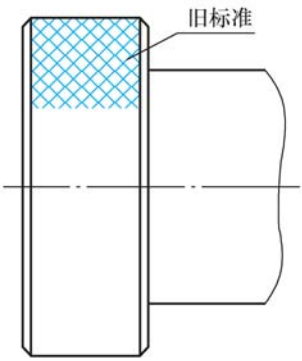
例 4-27　分析表示网纹滚花的正误



a) 立体图



b) 正

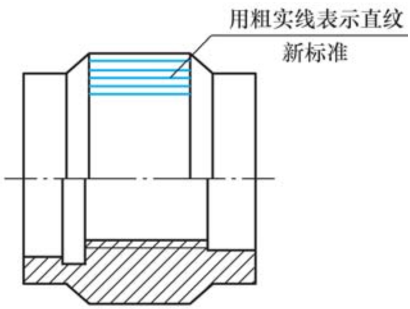


c) 误

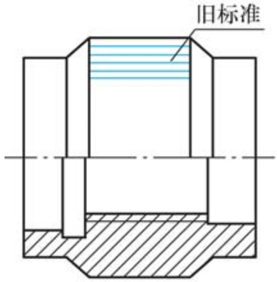
例 4-28　分析表示直纹滚花的正误



a) 立体图

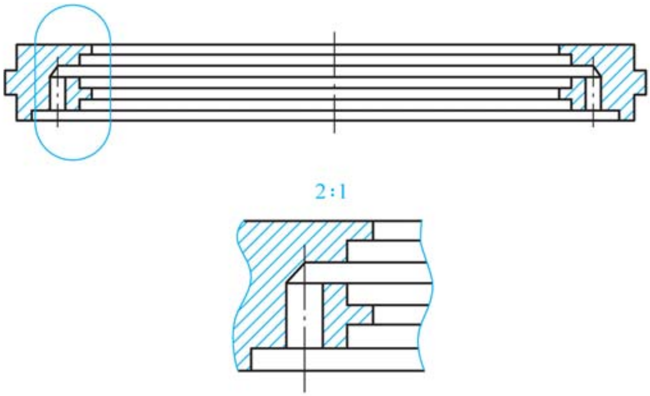


b) 正

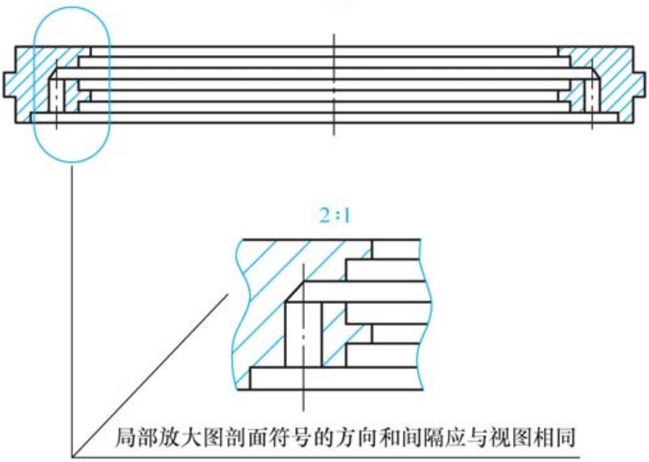


c) 误

例 4-29　分析零件局部放大图表达的正误



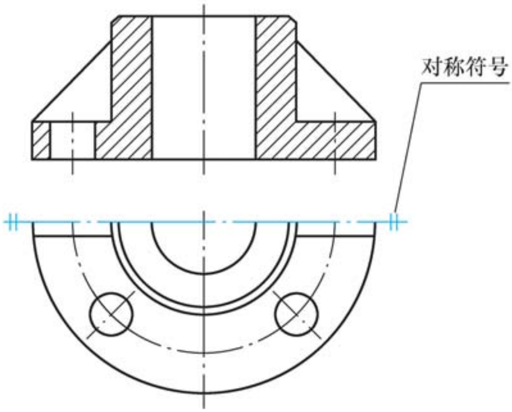
a) 正



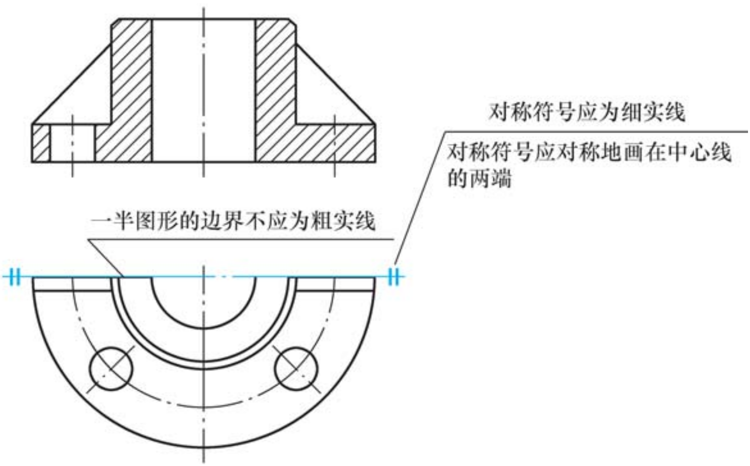
b) 误

扫码看视频讲解

例 4-30　分析零件对称结构表达的正误



a) 正

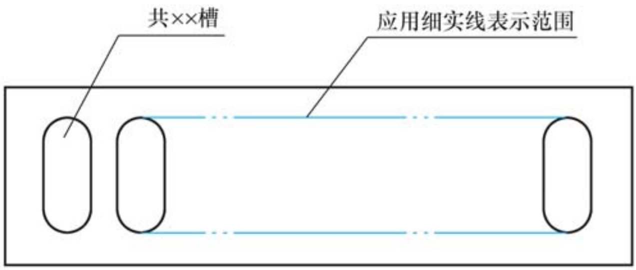


b) 误

例 4-31　分析零件重复结构表达的正误



a) 正



b) 误

扫码看视频讲解

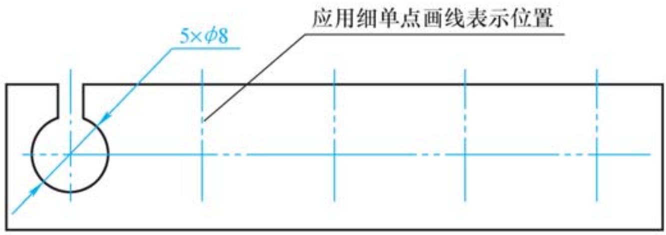
说明

当相同结构按一定规律分布时，只需要画出几个完整的结构，其他结构用细实线表示其范围。

例 4-32　分析零件重复结构表达的正误



a) 正

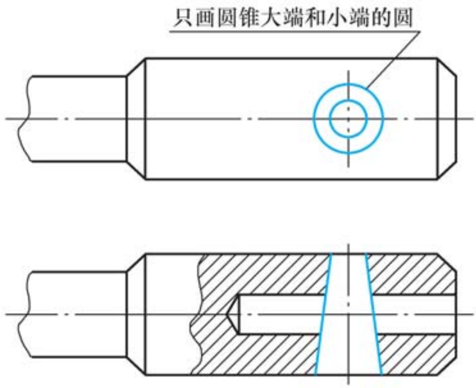


b) 误

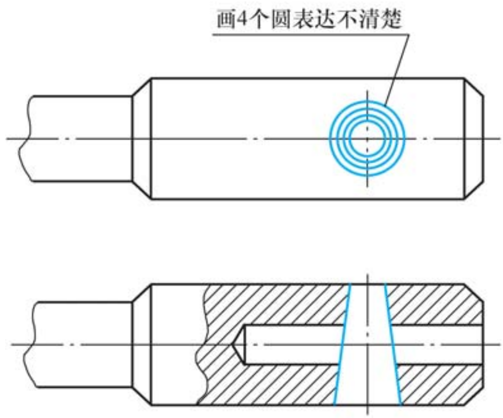
说明

当相同的对称结构按一定规律分布时，只需要画出一个完整的结构，其他对称的重复结构用细单点画线表示其位置。

例 4-33　分析零件小锥孔结构表达的正误



a) 正

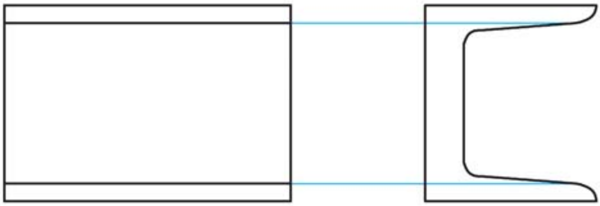


b) 误

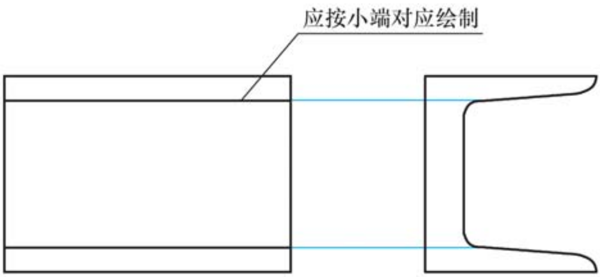
说明

为了图形清晰，小锥度可以简化成只画圆锥大端和小端的圆。

例 4-34　分析零件小斜度结构表达的正误



a) 正

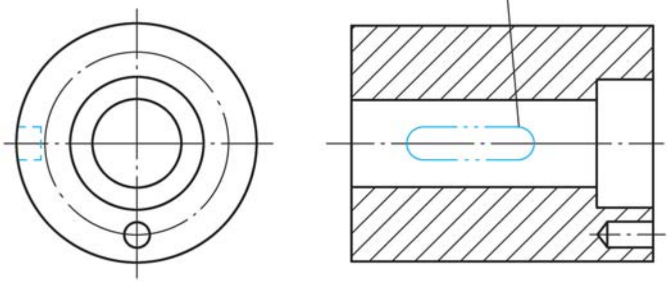


b) 误

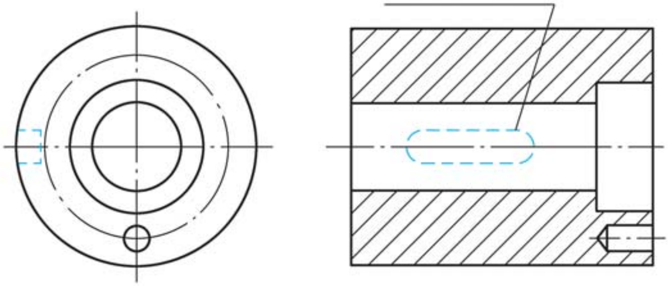
说明

零件上小斜度已经表达清楚时，在其他视图上可按小端绘制。

例 4-35　分析假想画法表达的正误



a) 正



b) 误

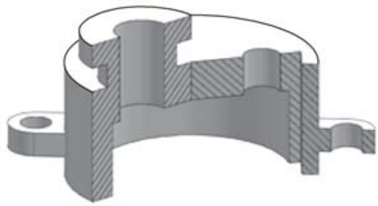
说明

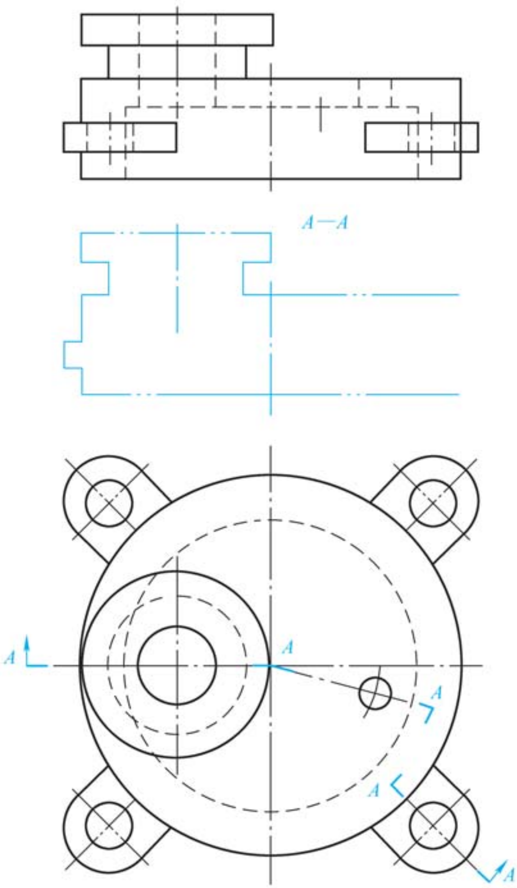
剖视图中被剖切掉的结构，可以假想没有剖掉，用细双点画线表达。

练一练

练习 4-1　根据主俯视图画出全剖主视图

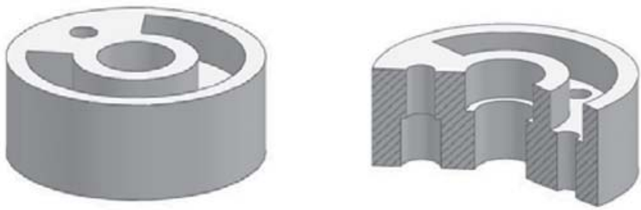


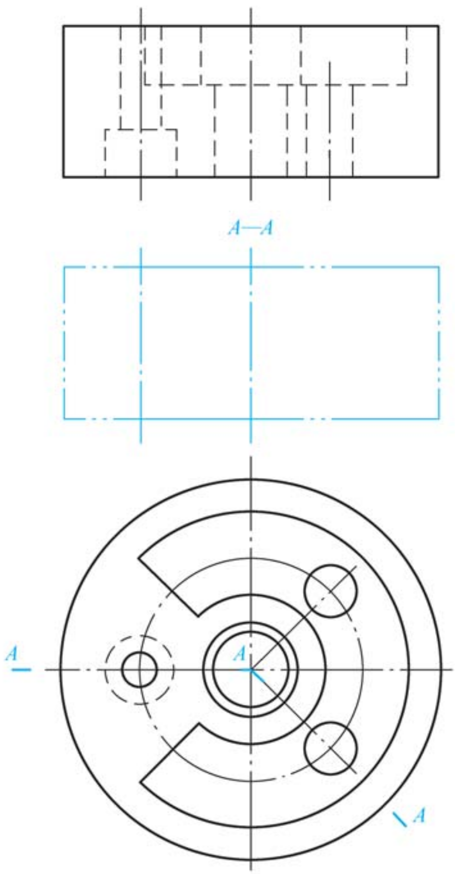




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练习 4-2　根据主俯视图将主视图改画为全剖视图

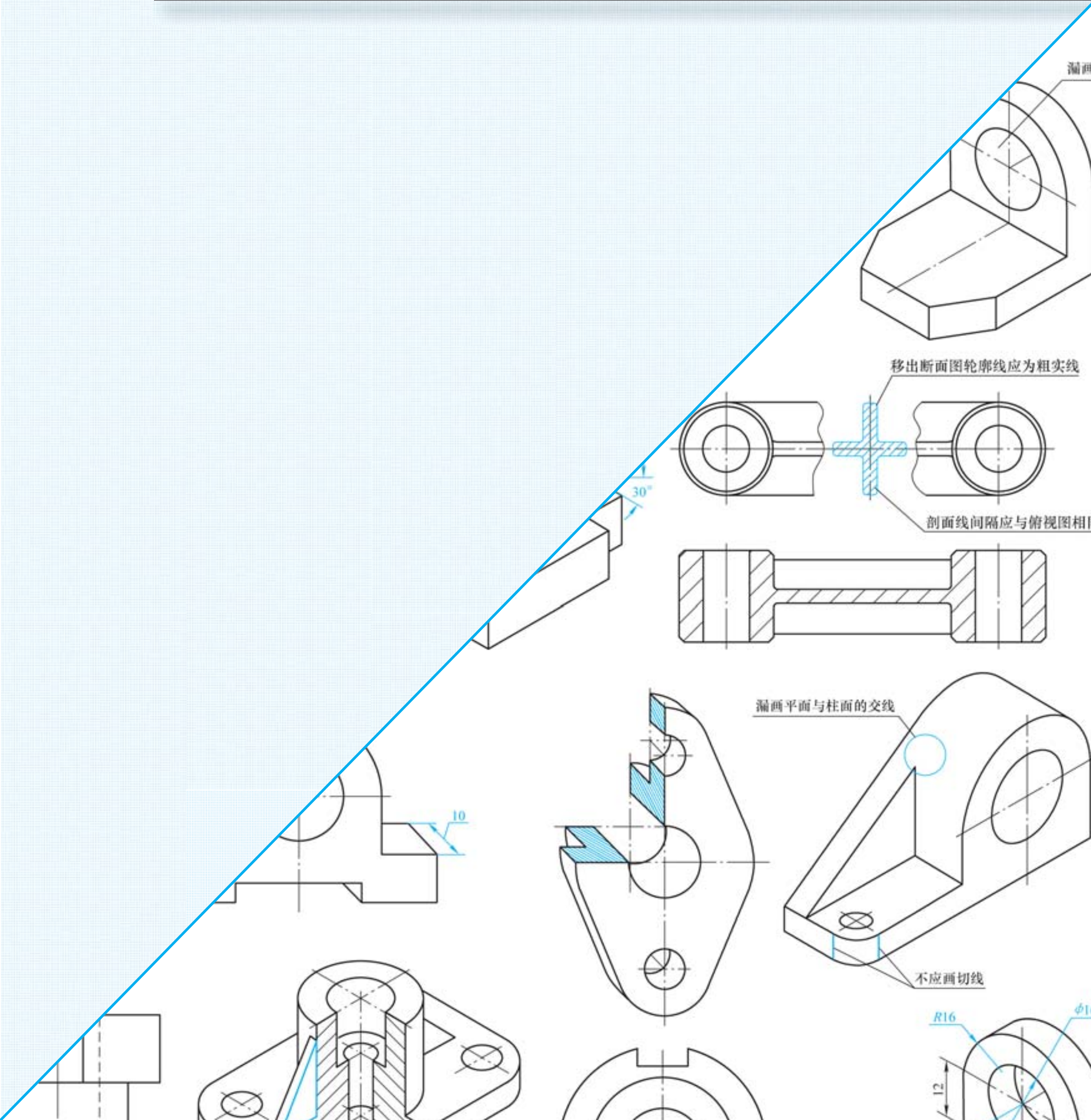






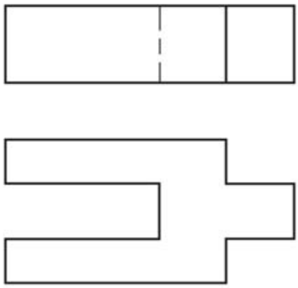
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第 5 章 轴测图

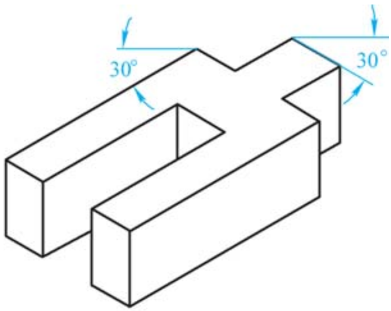


5.1 正等轴测图

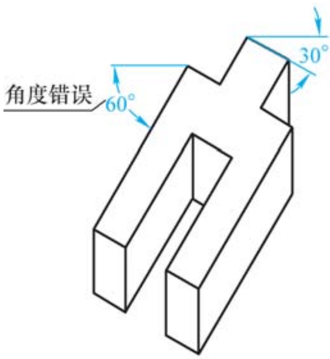
例 5-1　分析正等轴测图的正误



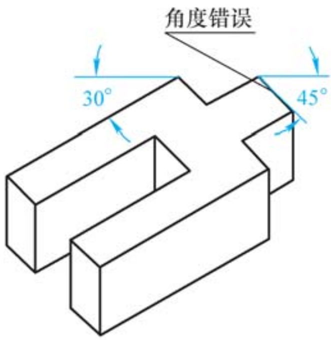
a) 视图



b) 正



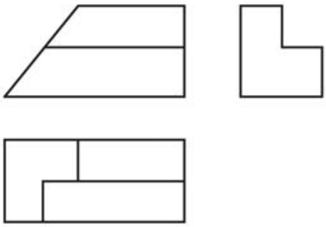
c) 误



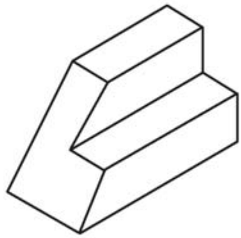
d) 误

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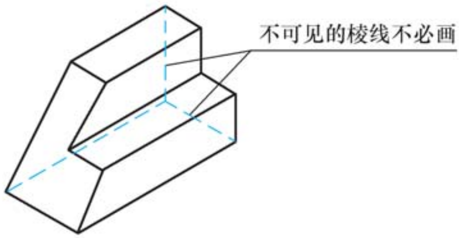
例 5-2　分析正等轴测图的正误



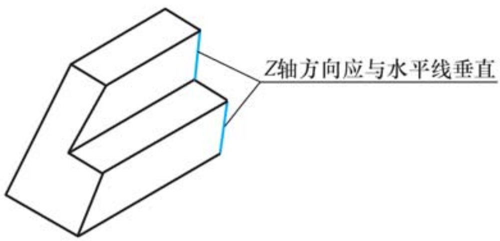
a) 视图



b) 正

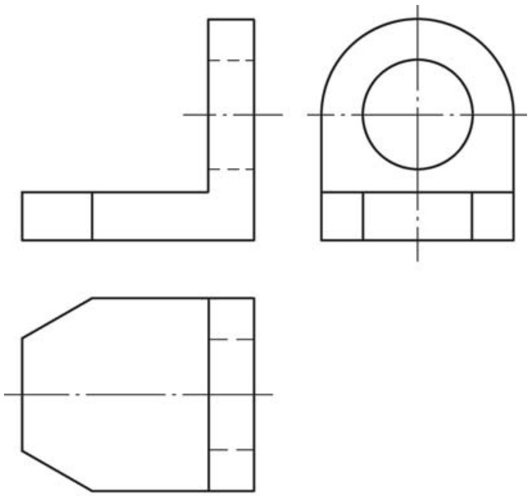


c) 误

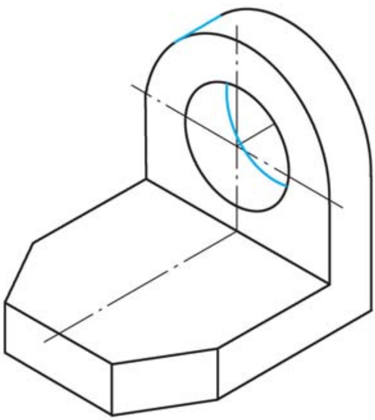


d) 误

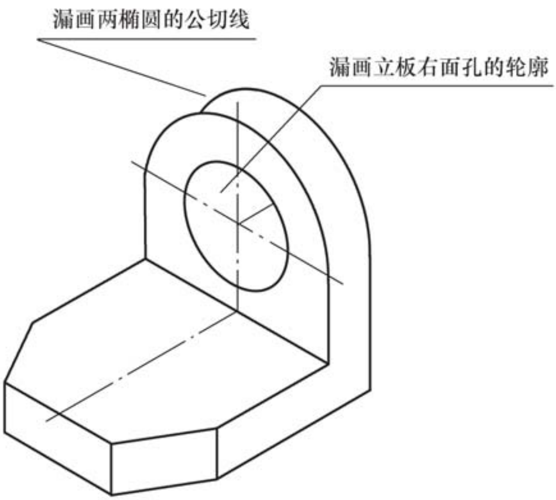
例 5-3　分析正等轴测图的正误



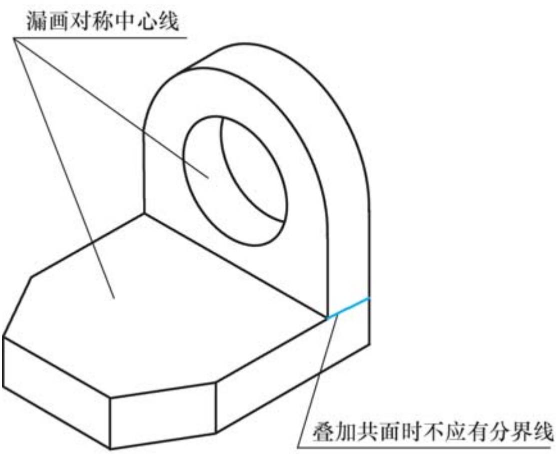
a) 视图



b) 正



c) 误

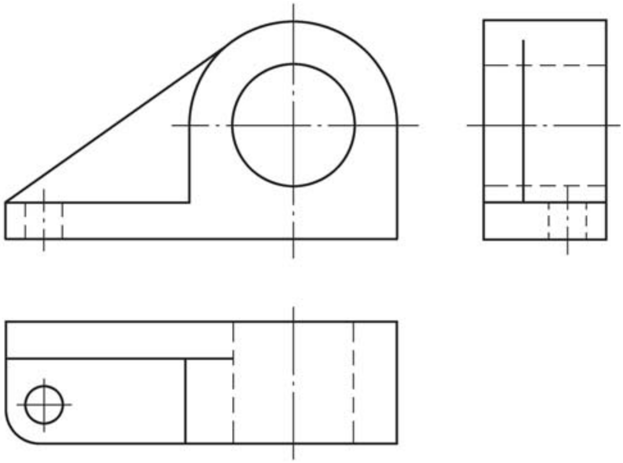


d) 误

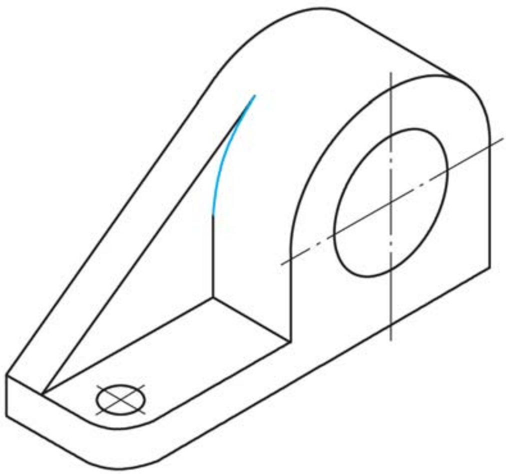


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例 5-4　分析正等轴测图的正误



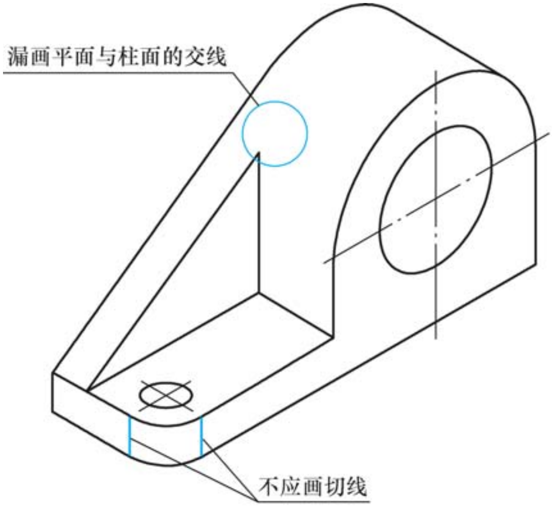
a) 视图



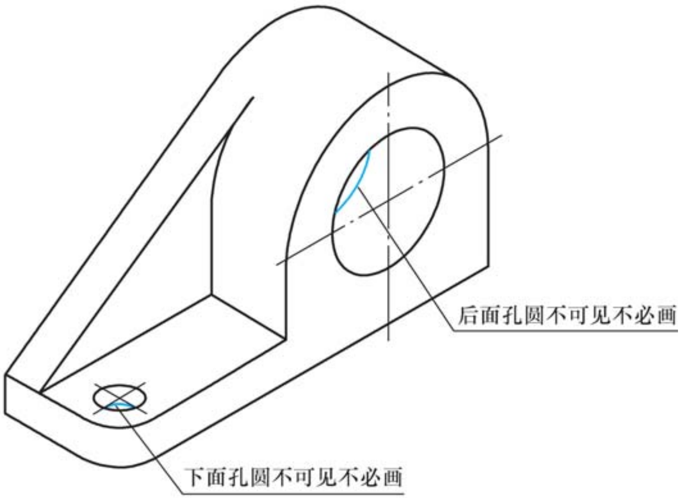
b) 正



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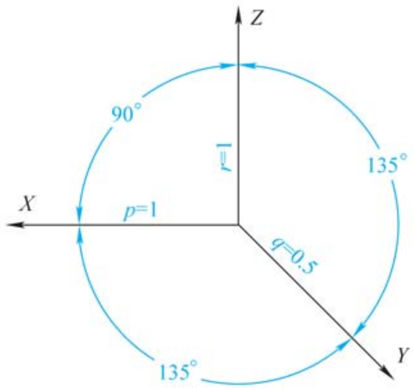
c) 误



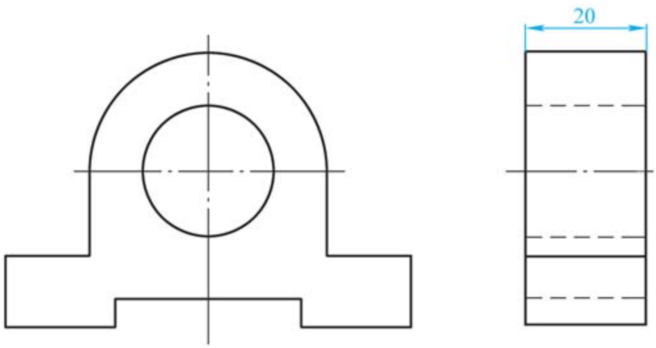
d) 误

5.2　斜二等轴测图

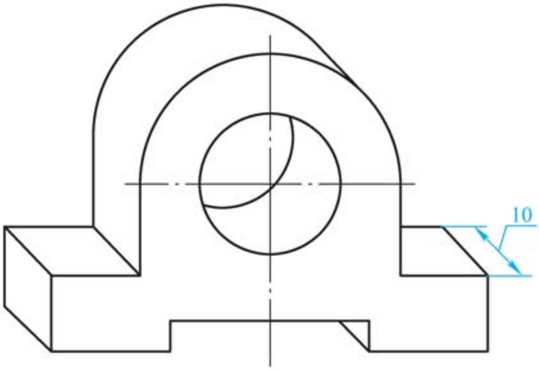
例 5-5　分析斜二等轴测图的正误



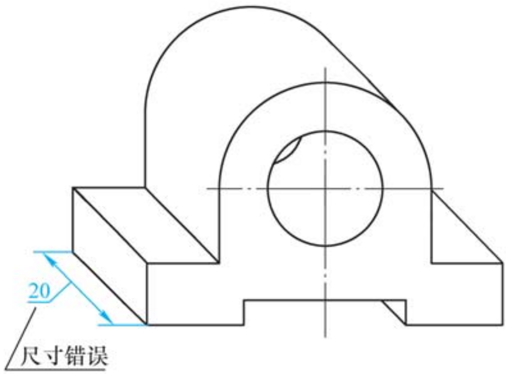
a) 斜二等轴测图轴间角和轴向伸缩系数



b) 视图



c) 正

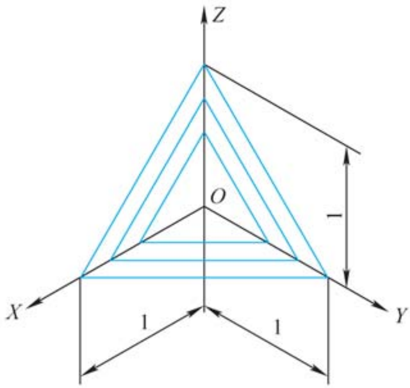


d) 误

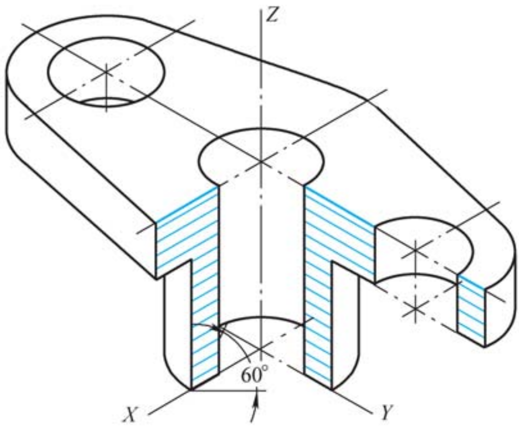
扫码看视频讲解

5.3　轴测剖视图

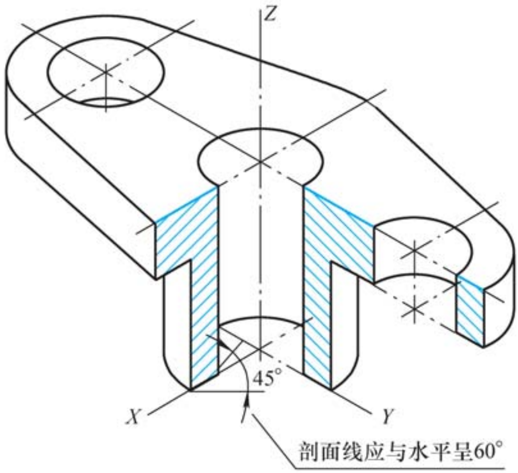
例 5-6　分析正等轴测剖视图的正误



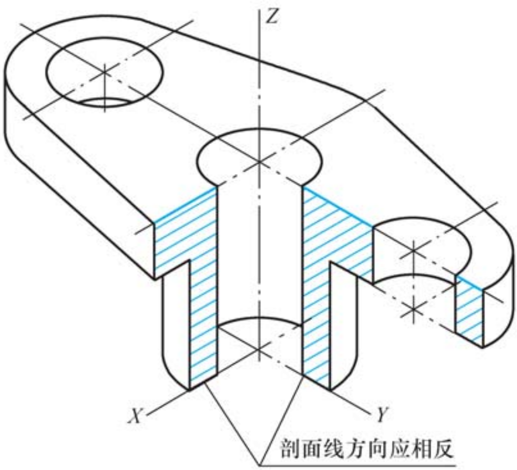
a) 正等轴测图剖面线方向



b) 正



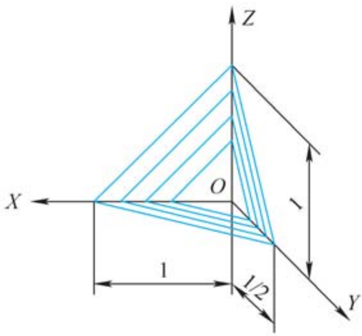
c) 误



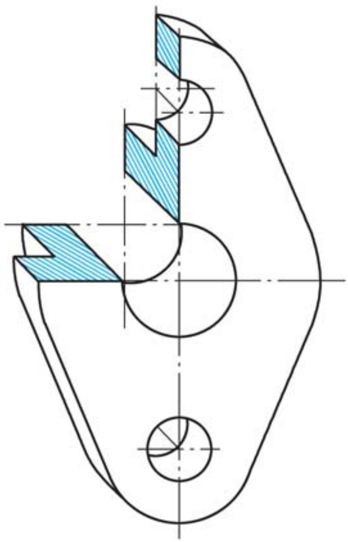
d) 误

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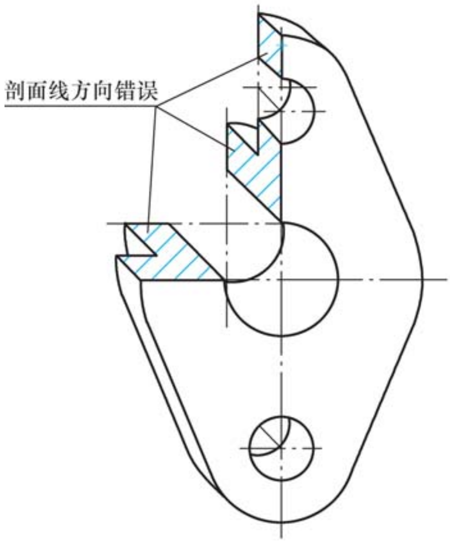
例 5-7　分析斜二等轴测剖视图的正误



a) 斜二等轴测图剖面线方向



b) 正



c) 误

说明

斜二等轴测图的适用场合：

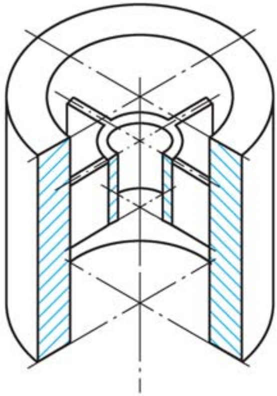
1. 一些平面立体，当采用正等轴测图表达不利于展现立体的直观效果时，可以采用斜二等轴测图。

2. 对于在一个投射方向上较复杂或有较多圆或圆弧，而在另两个投射方向上较简单或无圆的机件，可将圆或圆弧的平面与正投影面平行放置。

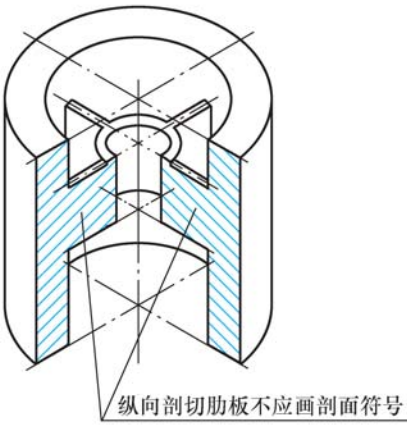
例 5-8　分析轴测剖视图中肋板表达的正误



扫码看视频讲解

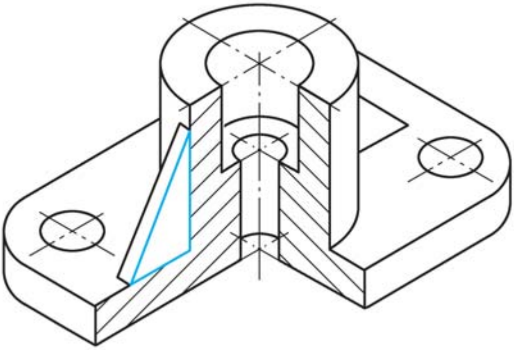


a) 正

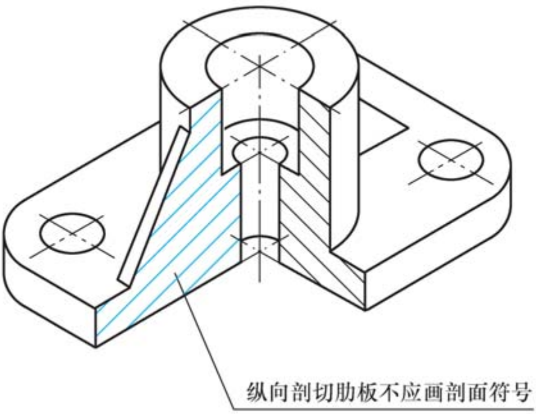


b) 误

例 5-9　分析轴测剖视图中肋板表达的正误



a) 正



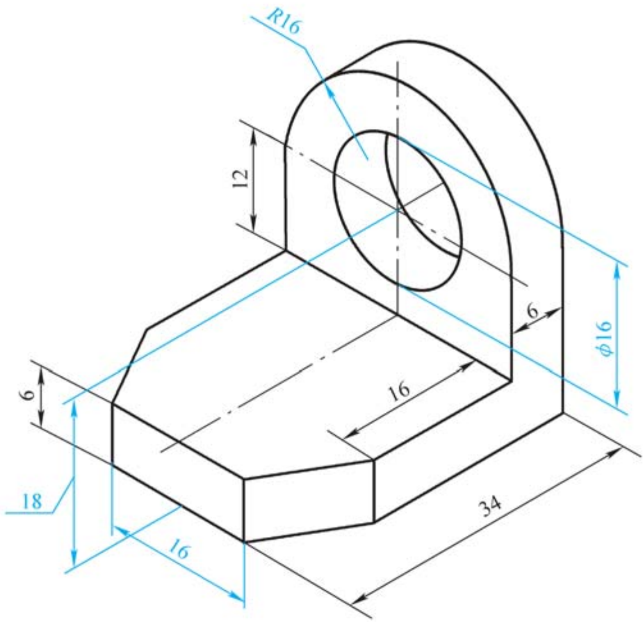
b) 误

说明

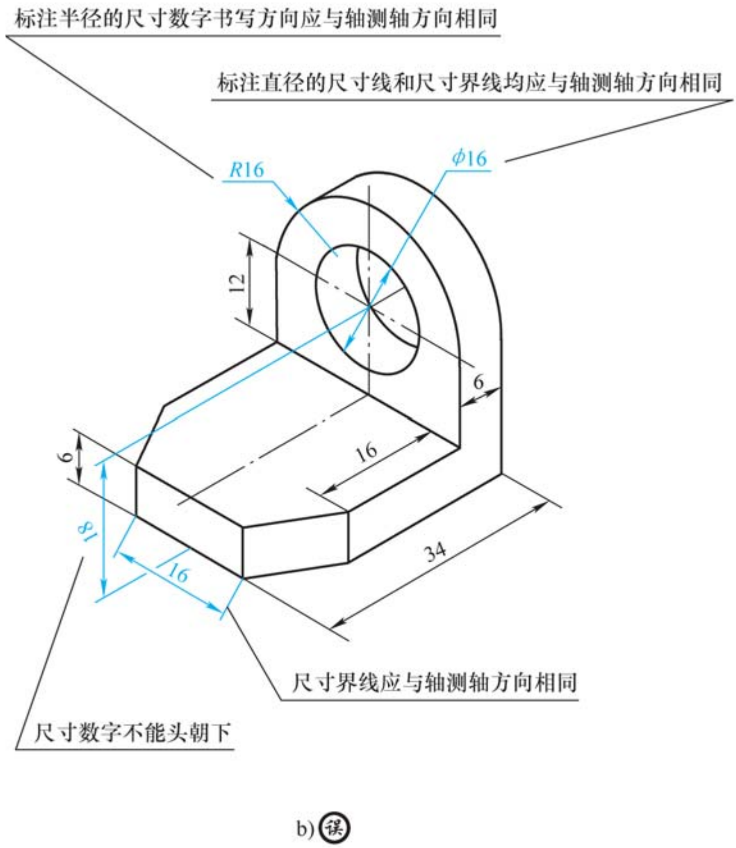
当剖切平面通过零件的肋或薄壁的纵向对称平面时，这些结构不画剖面线，只用粗实线与其他部分分开。

5.4 正等轴测图的尺寸标注

例 5-10 分析轴测图中尺寸标注的正误



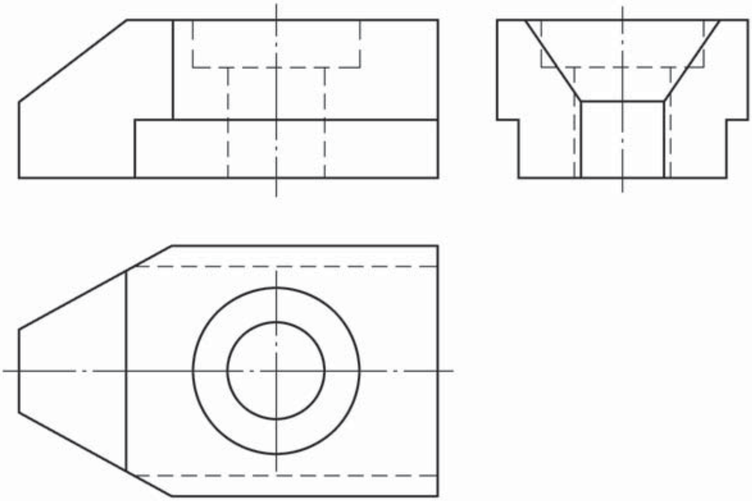
a) 正


标注半径的尺寸数字书写方向应与轴测轴方向相同
标注直径的尺寸线和尺寸界线均应与轴测轴方向相同
R16
ϕ16
12
6
16
6
18
16
34
尺寸界线应与轴测轴方向相同
尺寸数字不能头朝下

b) 误

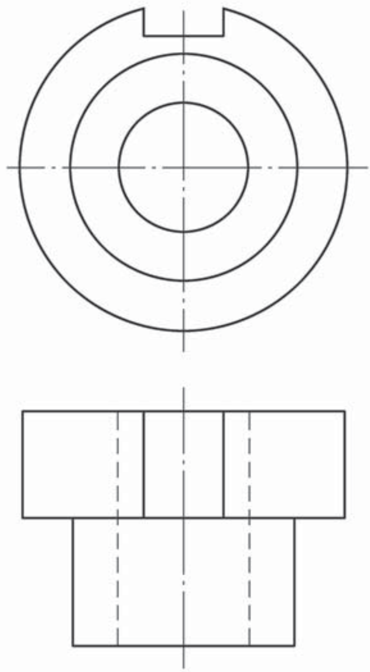
练一练

练习 5-1　根据三视图画出正等轴测图



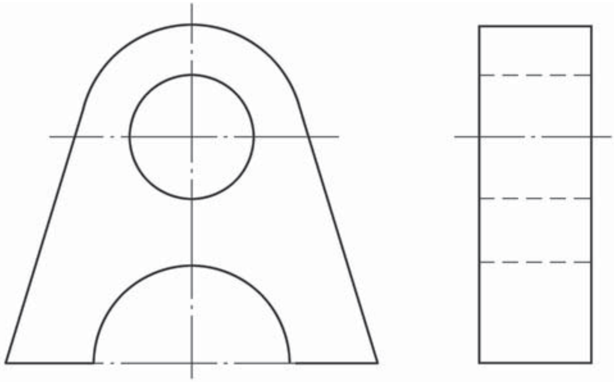
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练习 5-2　根据主俯视图画出斜二等轴测图



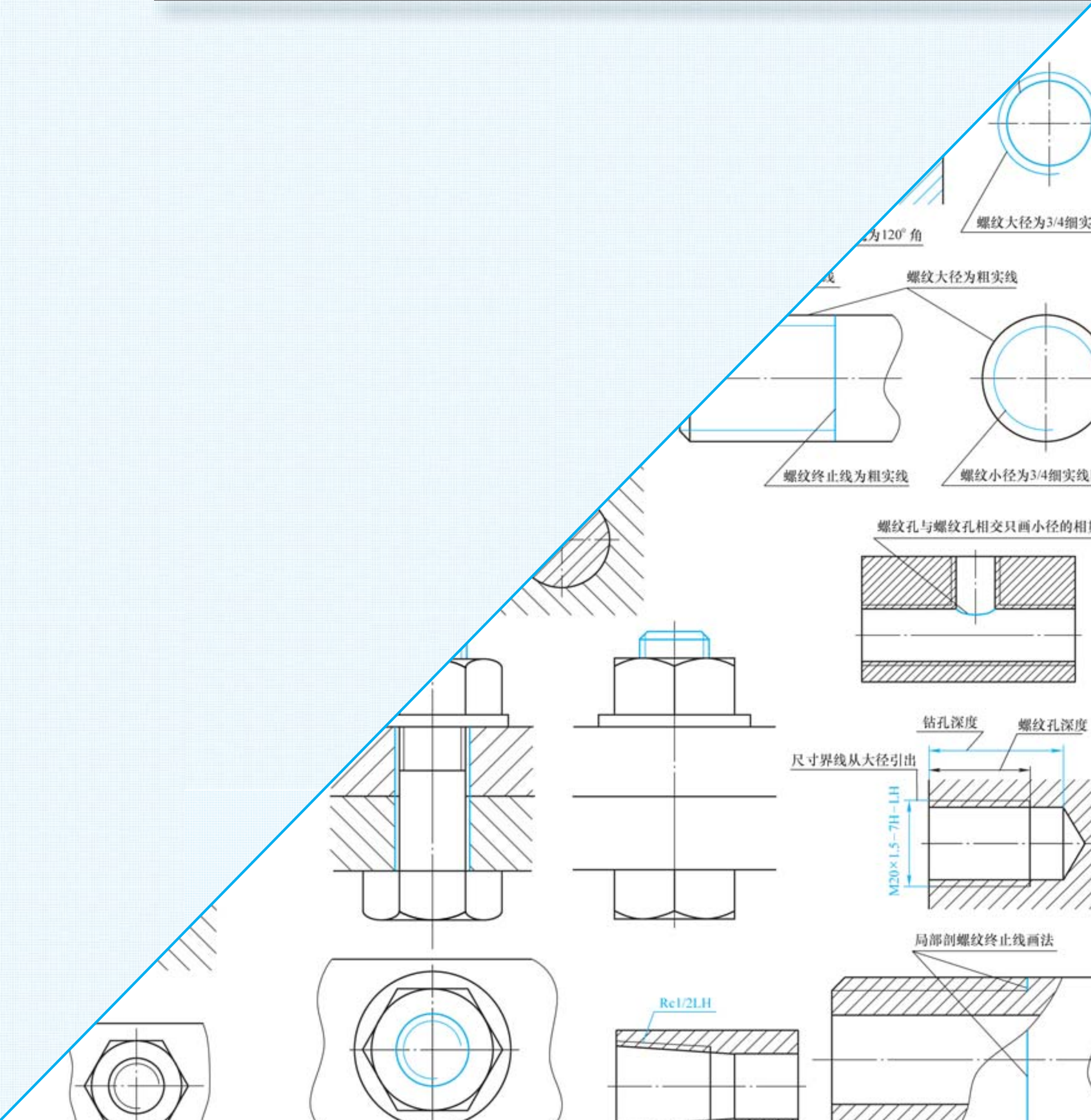
扫码看视频讲解

练习 5-3　根据主左视图画出斜二等轴测图



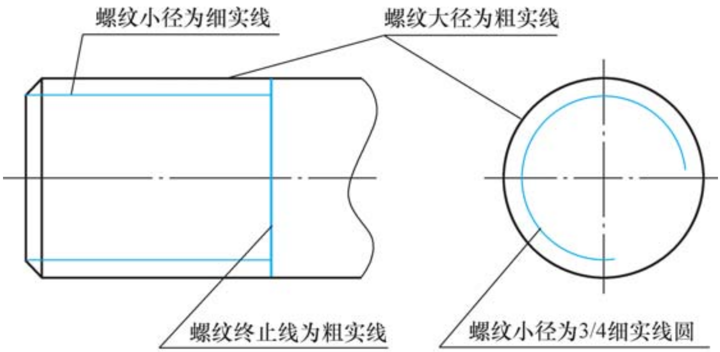
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第6章 标准件与常用件

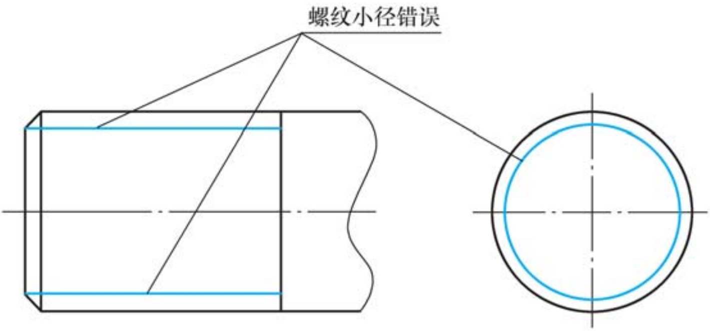

螺纹大径为粗实线
螺纹终止线为粗实线
钻孔深度
螺纹孔深度
尺寸界线从大径引出
M20×1.5−7H−LH
局部剖螺纹终止线画法
Rc1/2LH

6.1 螺纹规定画法

例 6-1 分析外螺纹画法的正误

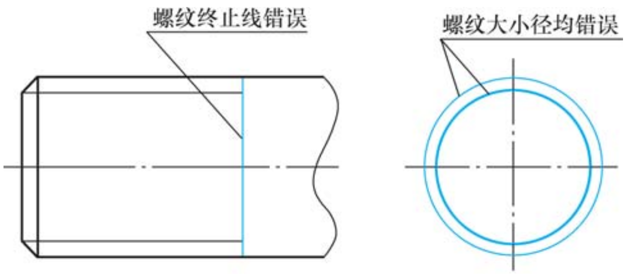


a) 正

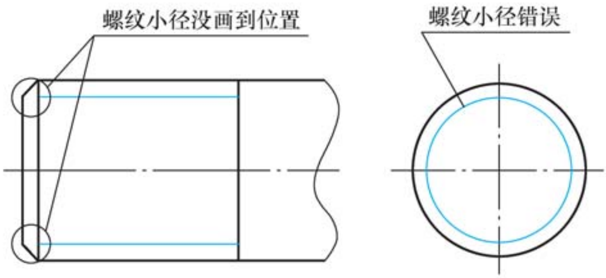


b) 误

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c) 误



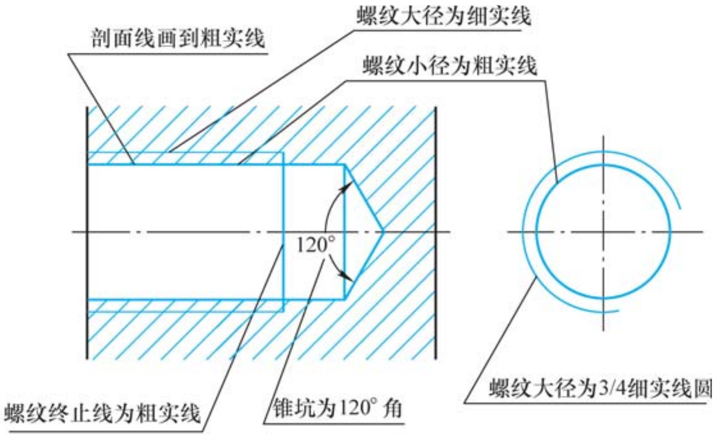
d) 误

说明

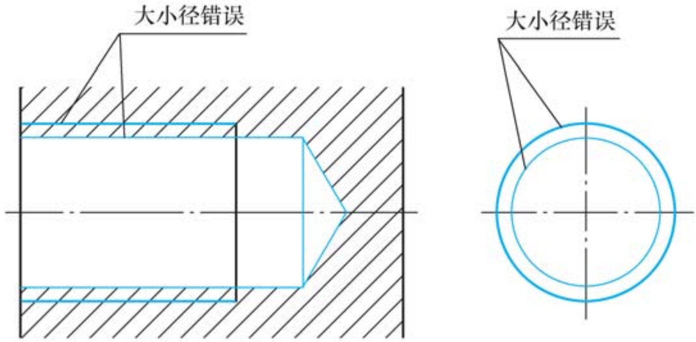
螺纹的表示法主要是画螺纹的大径、小径和螺纹终止线。

1. 螺纹大径用粗实线画。
2. 螺纹小径用细实线画。
3. 螺纹终止线用粗实线画。
4. 在反映圆的视图中，螺纹小径用 3/4 细实线圆画。

例 6-2　分析内螺纹画法的正误

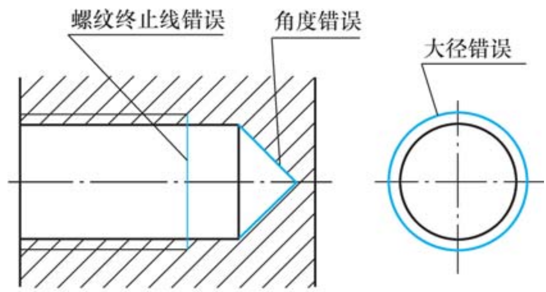


a) 正

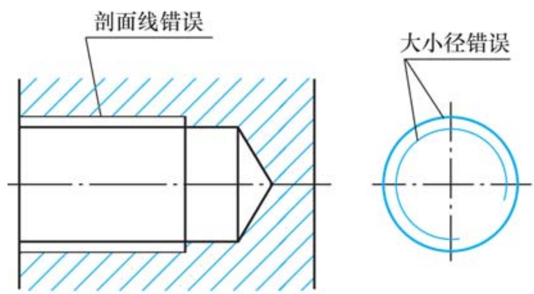


b) 误

扫码看视频讲解



c) 误



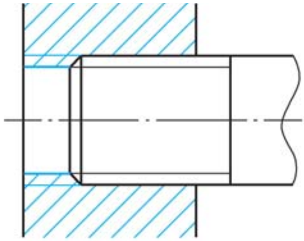
d) 误

说明

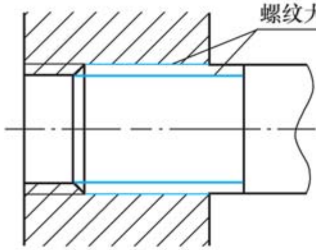
内螺纹一般用剖视图表示。

1. 螺纹小径用粗实线画。
2. 螺纹大径用细实线画。
3. 螺纹终止线用粗实线画。
4. 在反映圆的视图中，螺纹大径用 3/4 细实线圆画。

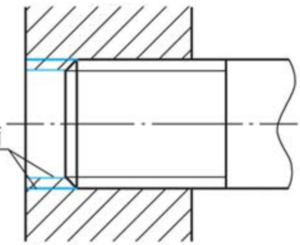
例 6-3　分析内外螺纹联接画法的正误



a) 正



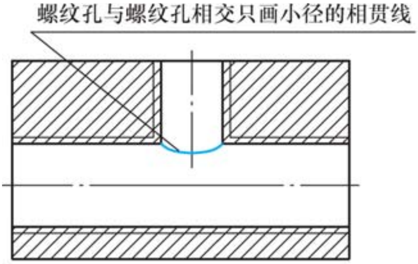
b) 误



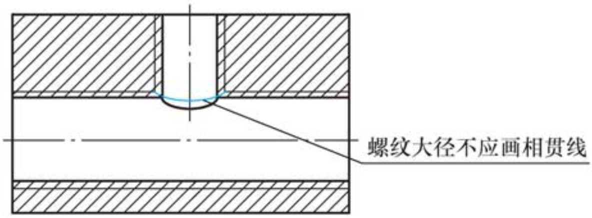
c) 误

扫码看视频讲解

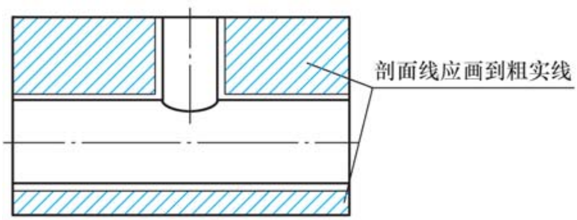
例 6-4　分析螺孔中相贯线画法的正误



a) 正



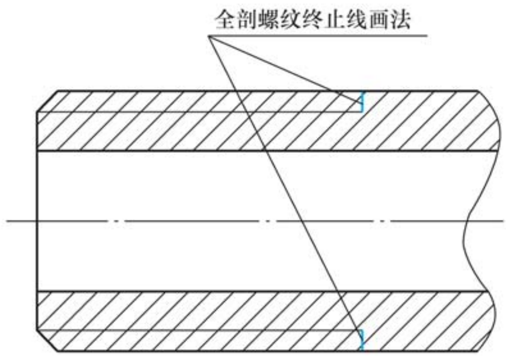
b) 误



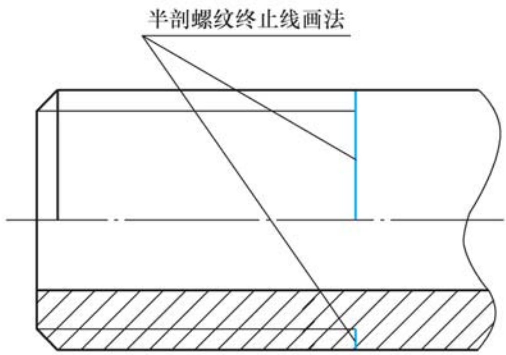
c) 误

扫码看视频讲解

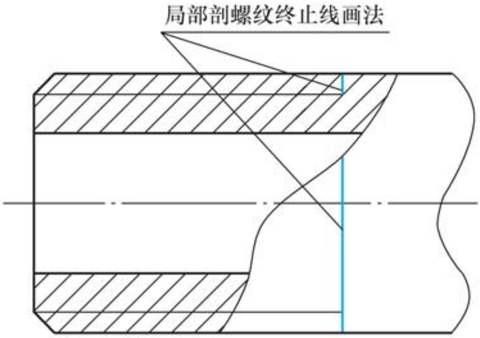
例 6-5　分析管螺纹画法的正误



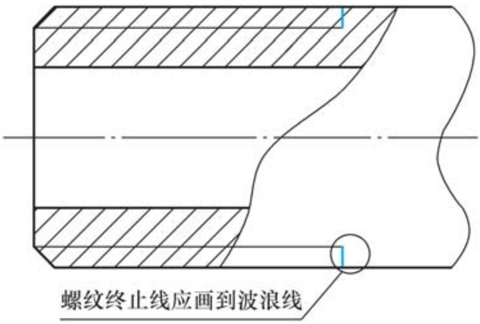
a) 正



b) 正



c) 正



d) 误

扫码看视频讲解

说明

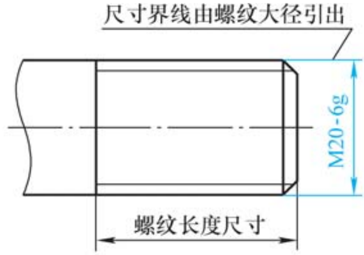
管螺纹一般用全剖、半剖或局部剖表示。

1. 在剖视部分，螺纹终止线只画牙高部分。

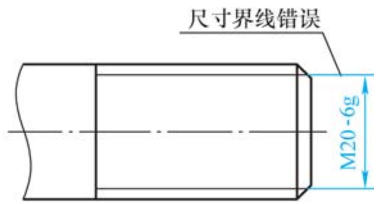
2. 在视图部分，螺纹终止线应画到点画线或波浪线。

6.2　螺纹标注

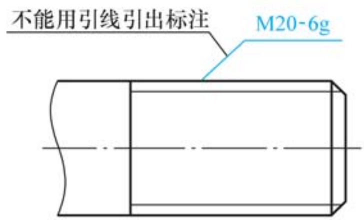
例 6-6　分析普通外螺纹标注的正误



a) 正



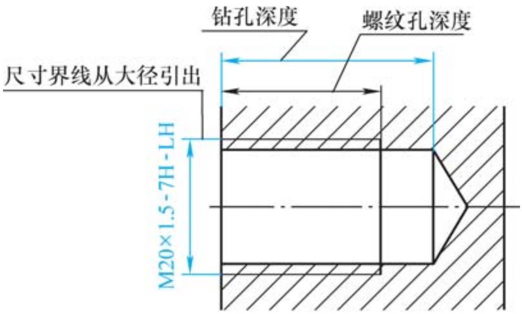
b) 误



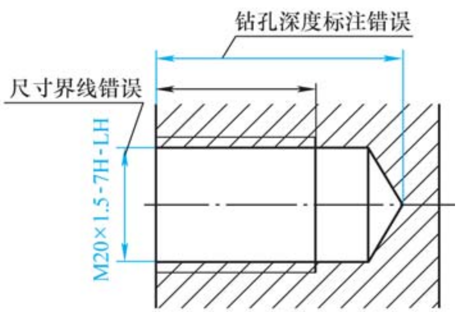
c) 误

扫码看视频讲解

例 6-7　分析普通内螺纹标注的正误



a) 正



b) 误

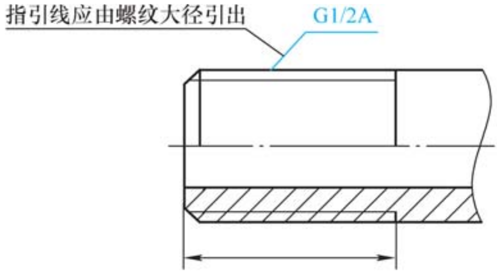
说明

普通螺纹标注格式：

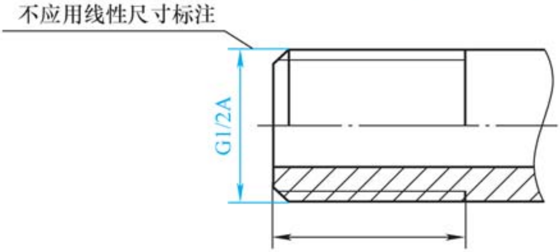
螺纹特征代号 公称直径 ×Ph 导程 P 螺距 - 公差带代号 - 旋合长度代号 - 旋向代号

米制螺纹尺寸标注在螺纹大径上。

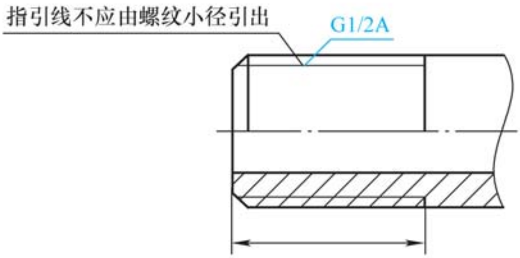
例 6-8　分析管螺纹标注的正误



a) 正



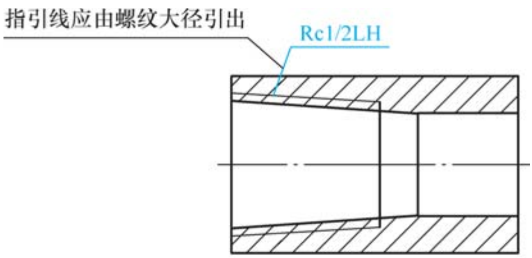
b) 误



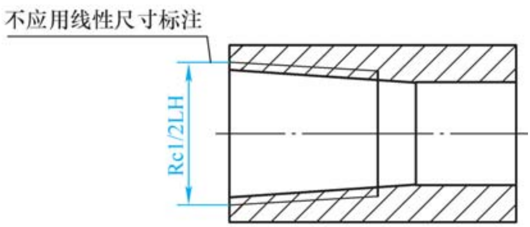
c) 误

扫码看视频讲解

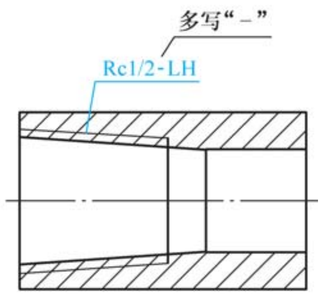
例 6-9　分析管螺纹标注的正误



a) 正



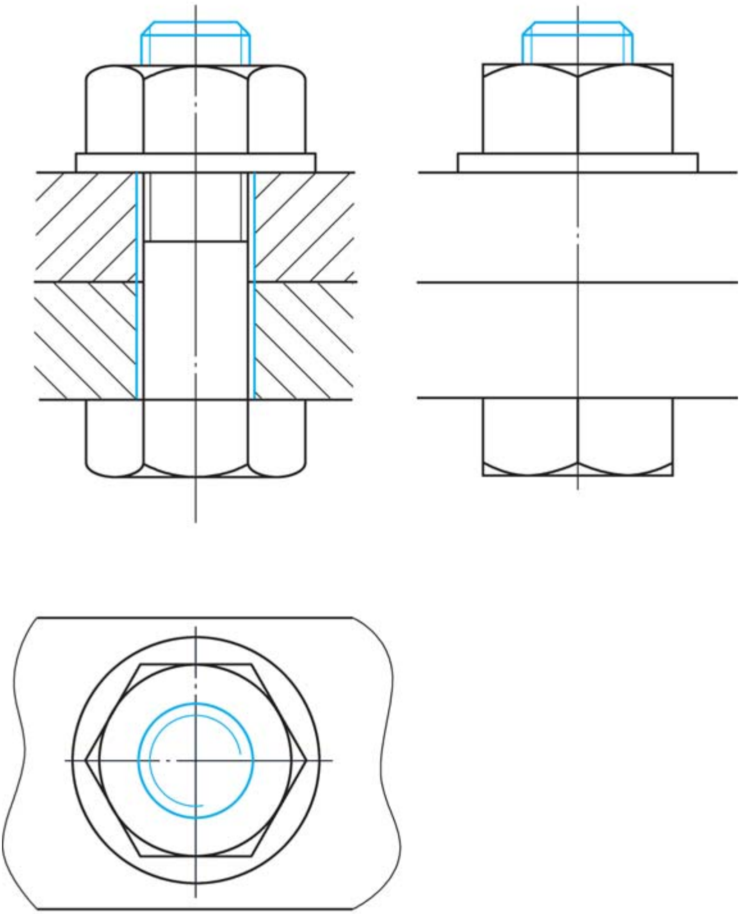
b) 误



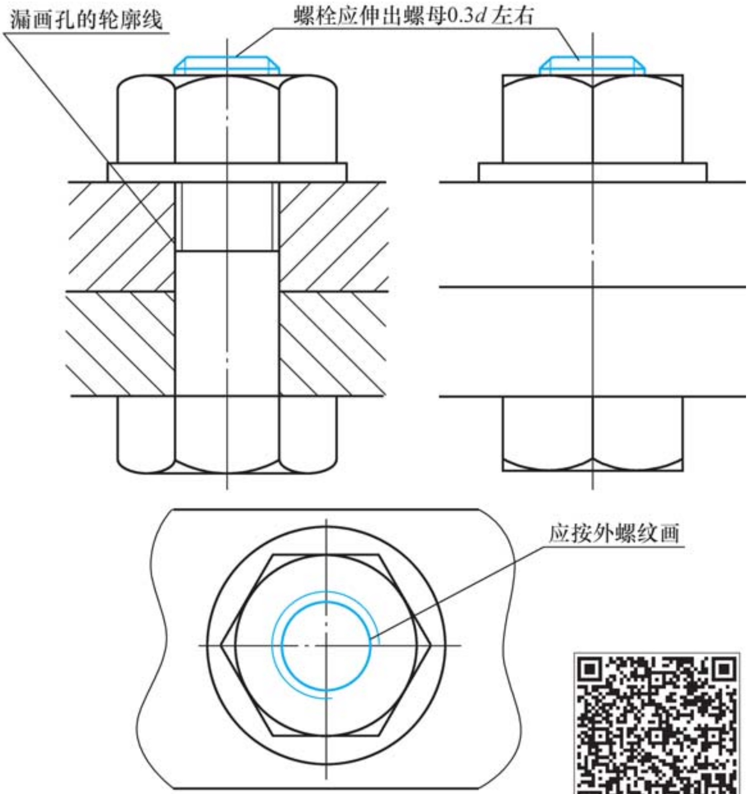
c) 误

6.3 螺纹联接画法

例 6-10　分析螺栓联接画法的正误



a) 正



b) 误

扫码看视频讲解

说明

螺栓的公称长度 l 是由各件的尺寸之和确定的

$$l=\delta_1+\delta_2+h+m+a$$

式中　δ_1、δ_2——被联接件的厚度；

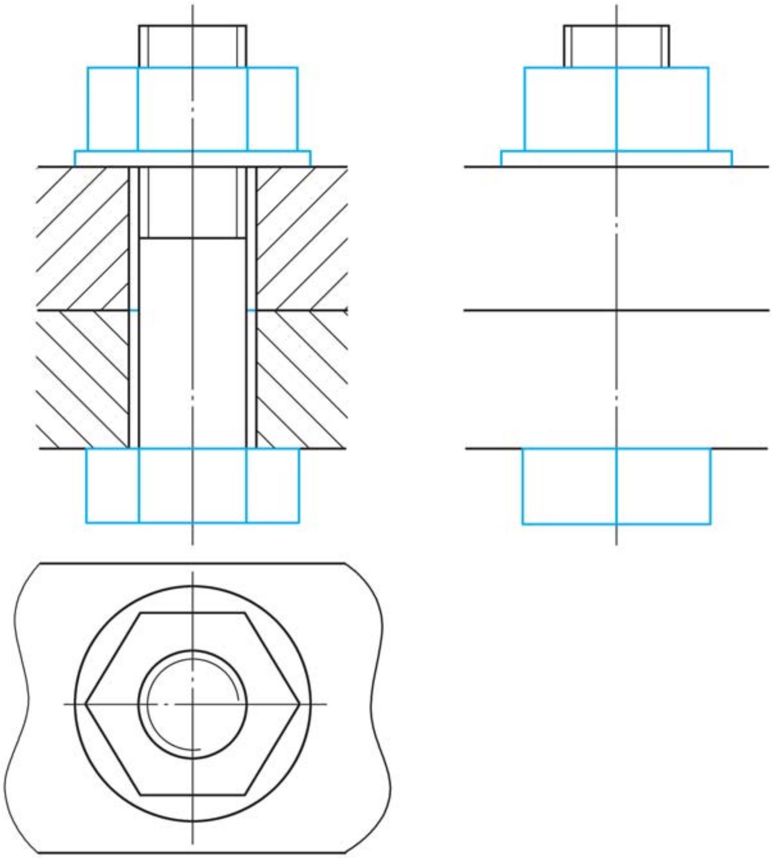
h——垫圈厚度（0.15d）；

m——螺母厚度（0.8d，d 为螺纹大径）；

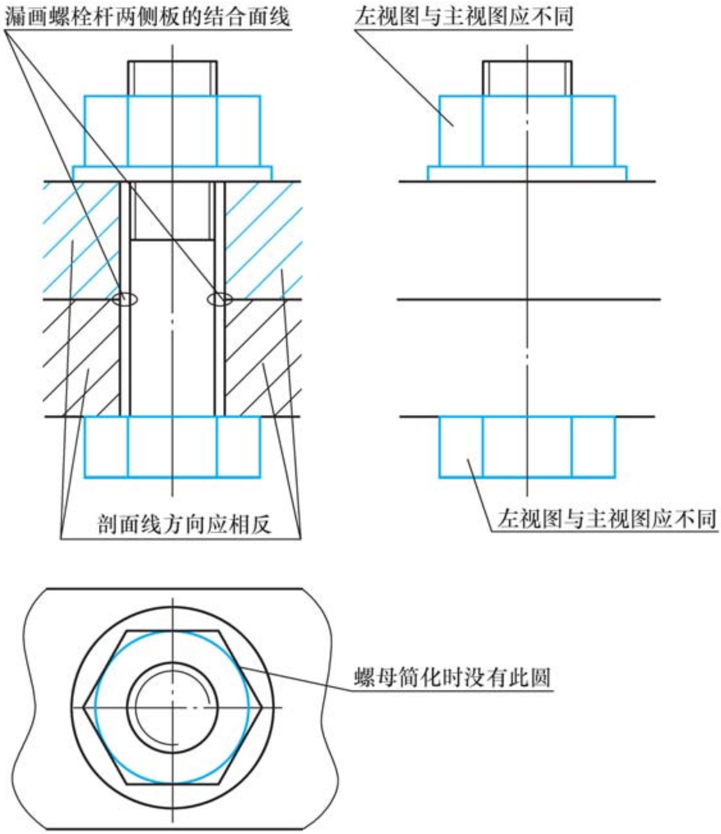
a——螺栓伸出螺母顶面的高度(一般取 a=0.2d~0.3d)。

按上式计算出的长度，还需要在标准中取接近的标准长度。

例 6-11　分析螺栓联接简化画法的正误

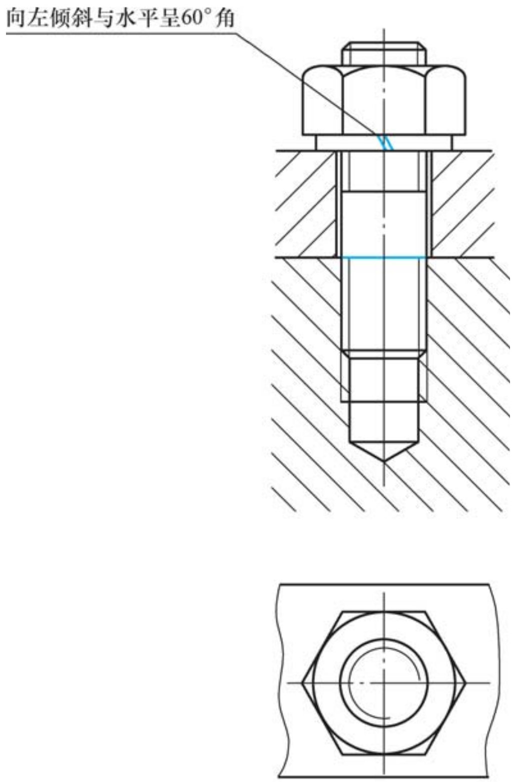


a) 正

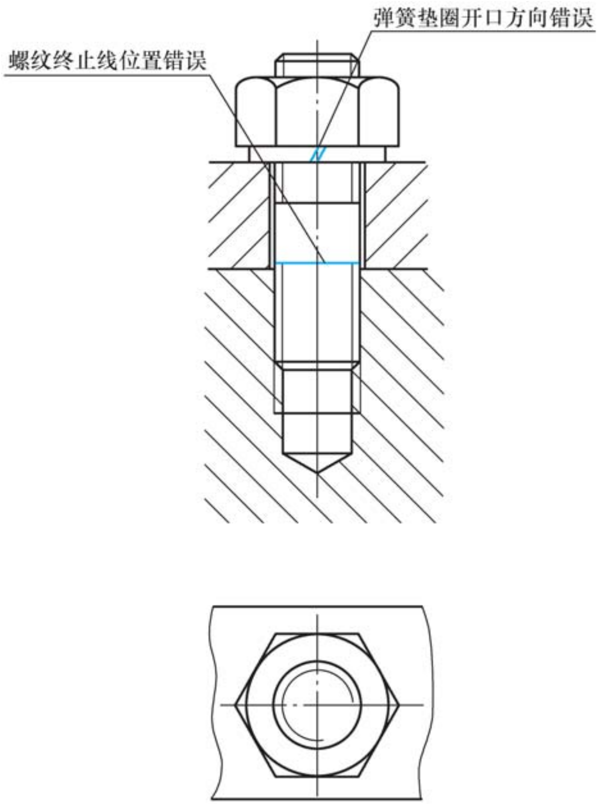

漏画螺栓杆两侧板的结合面线
左视图与主视图应不同
剖面线方向应相反
左视图与主视图应不同
螺母简化时没有此圆

b) 误

例 6-12　分析螺柱联接画法的正误

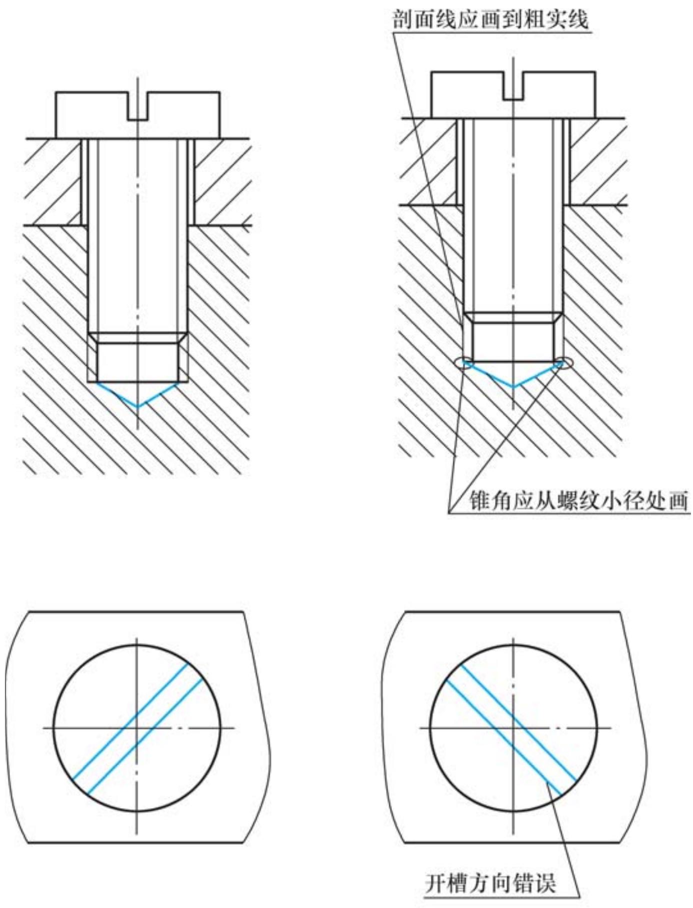


a) 正



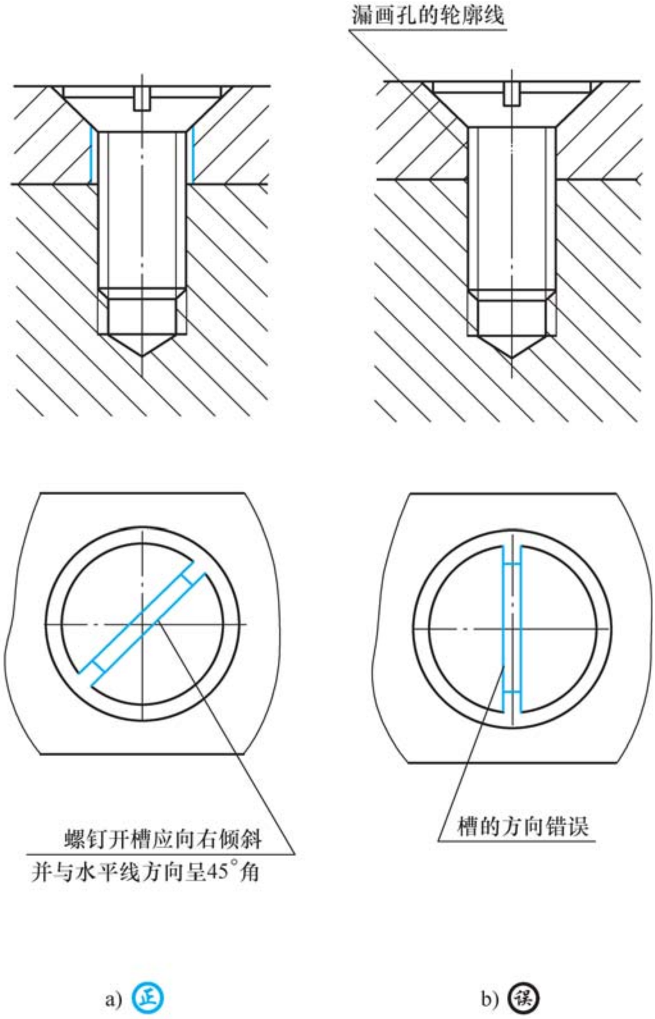
b) 误

例 6-13　分析螺钉联接画法的正误



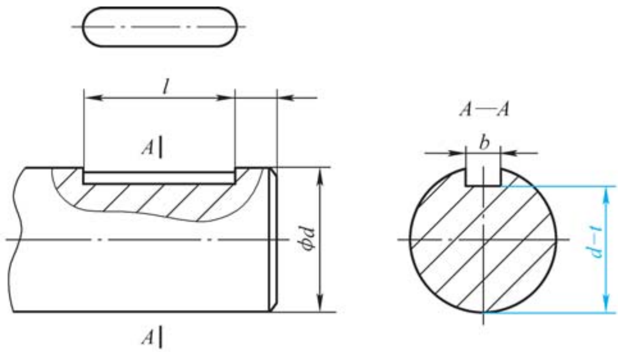
a) 正　　b) 误

例 6-14　分析螺钉联接画法的正误

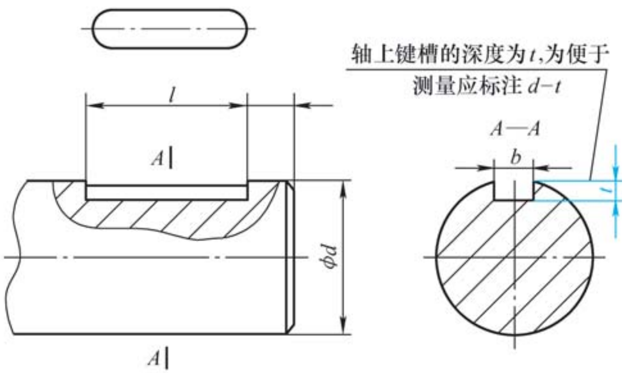


6.4 键

例 6-15 分析轴上键槽尺寸标注的正误



a) 正

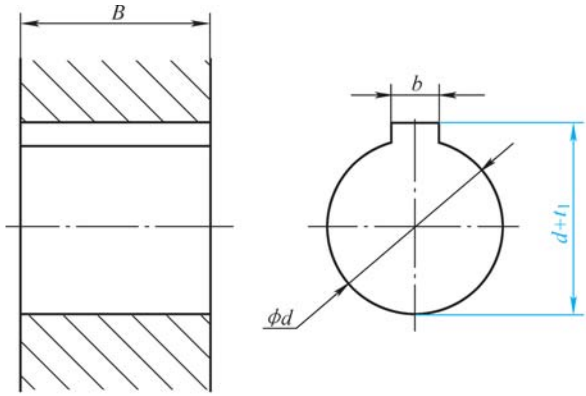


b) 误

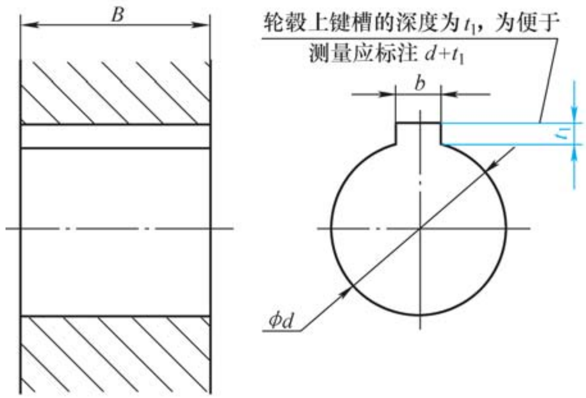


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例 6-16　分析轮毂上键槽尺寸标注的正误



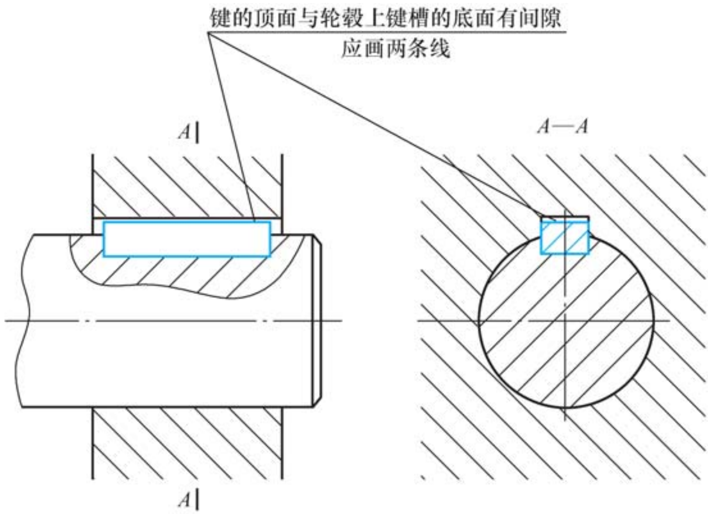
a) 正



b) 误

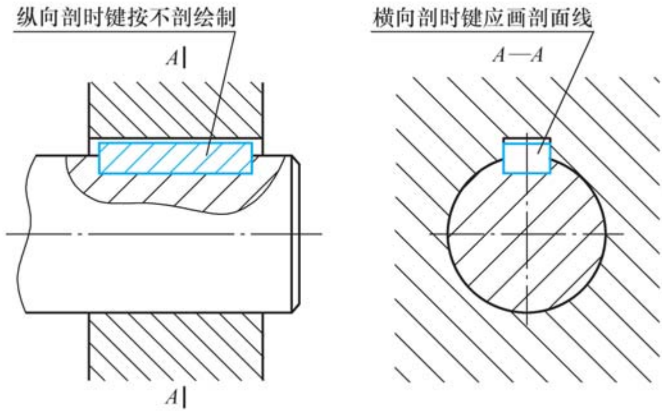
扫码看视频讲解

例 6-17　分析普通平键联接画法的正误

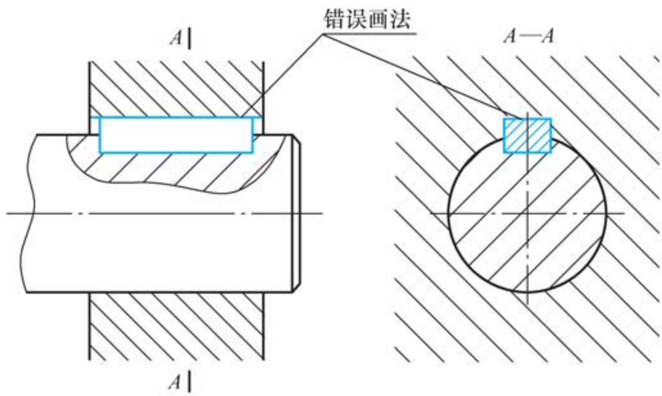


a) 正


扫码看视频讲解



b) 误

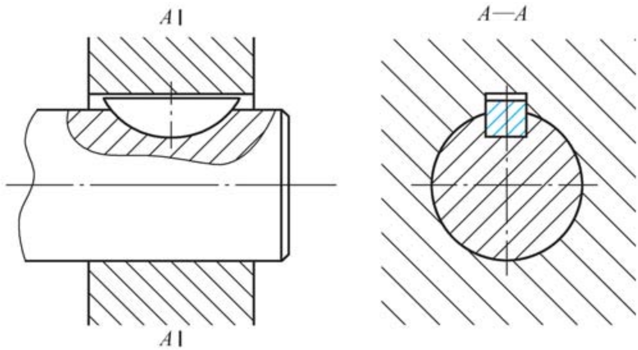


c) 误

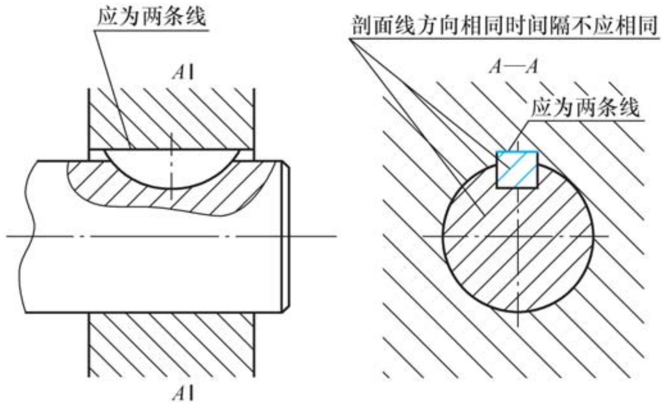
说明

普通平键的两侧面是工作面，因此，两侧面无间隙，画一条线，上面有间隙，画两条线。

例 6-18　分析半圆键联接画法的正误

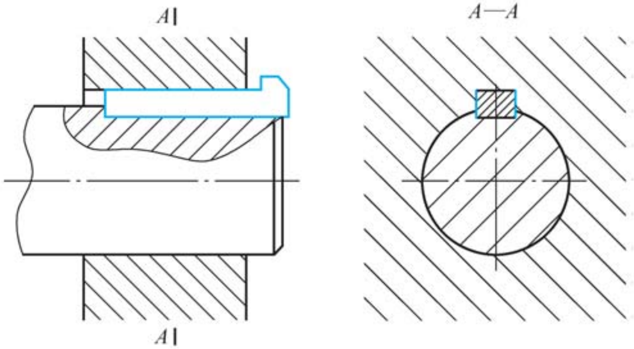


a) 正

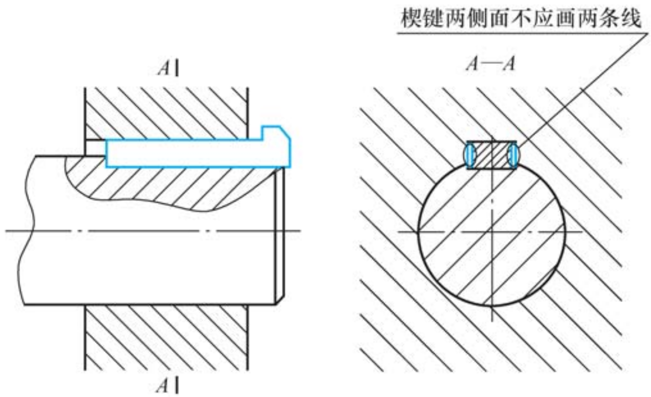


b) 误

例 6-19　分析钩头楔键联接画法的正误



a) 正

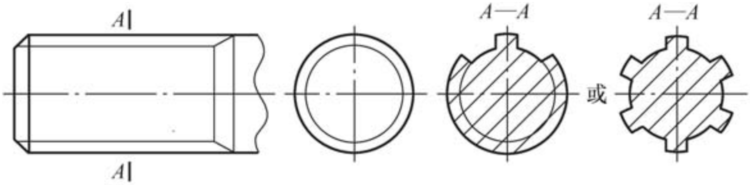


b) 误

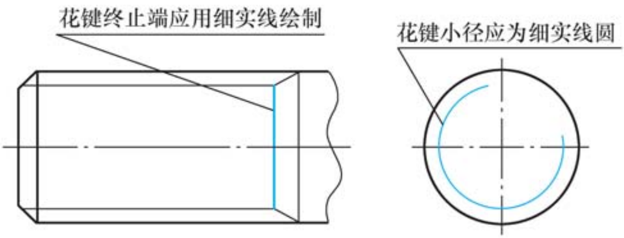
说明

钩头楔键的宽度尺寸与键槽的宽度尺寸相同，因此侧面不应有间隙。

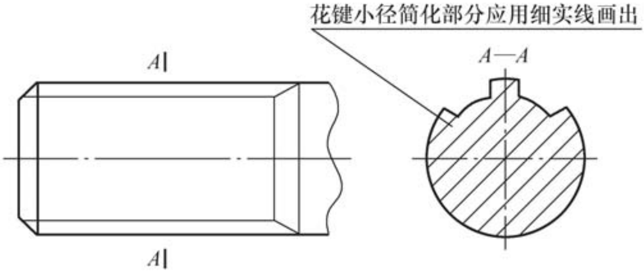
例 6-20　分析矩形外花键画法的正误



a) 正

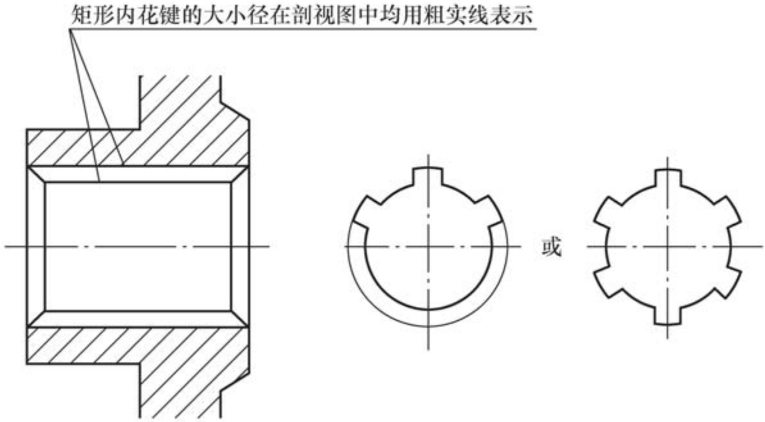


b) 误

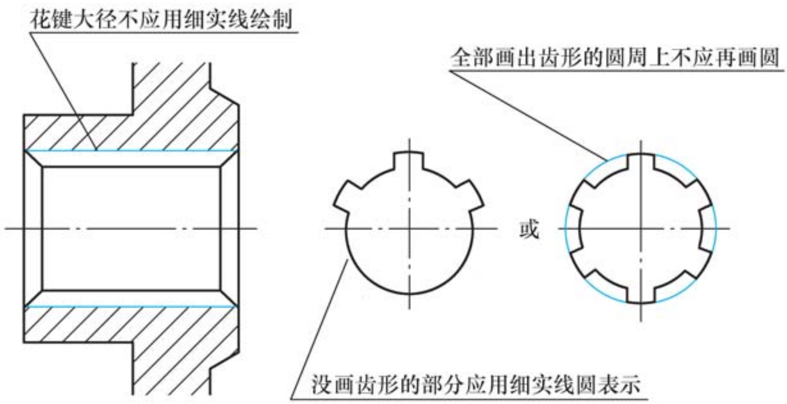


c) 误

例 6-21　分析矩形内花键画法的正误



a) 正

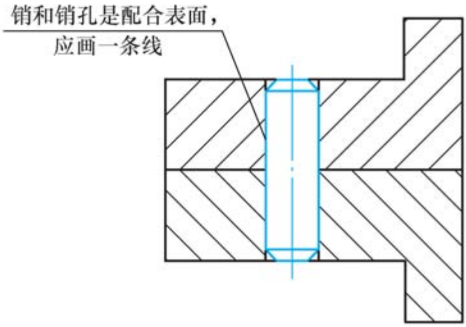


b) 误

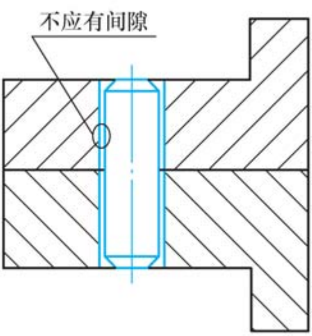
6.5 销

例 6-22　分析销配合画法的正误

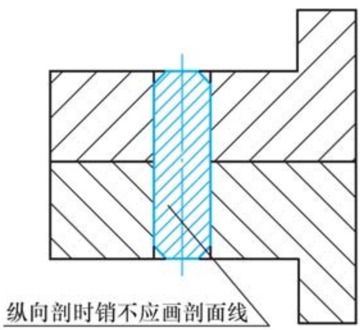
扫码看视频讲解



a) 正



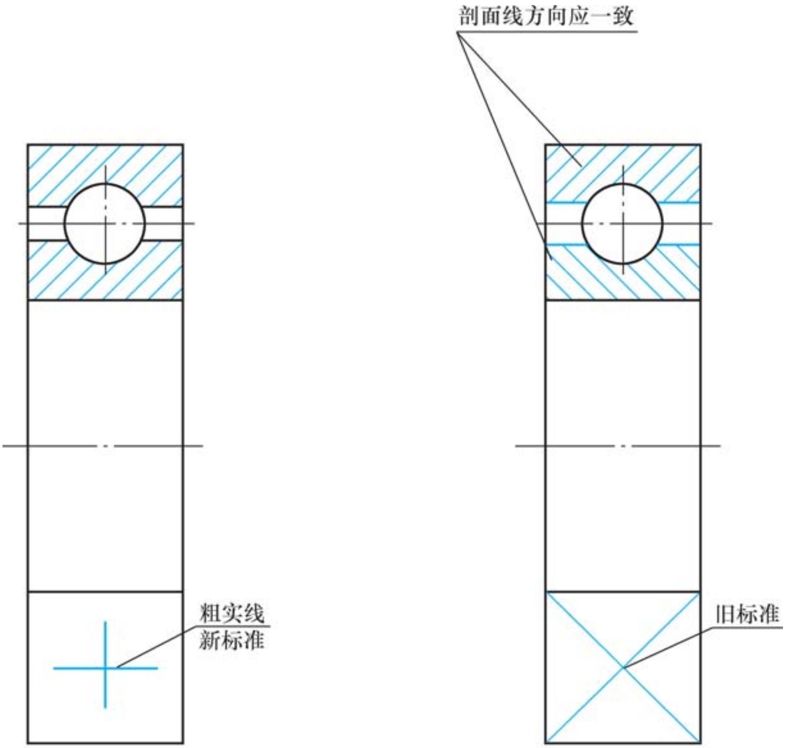
b) 误



c) 误

6.6　轴承

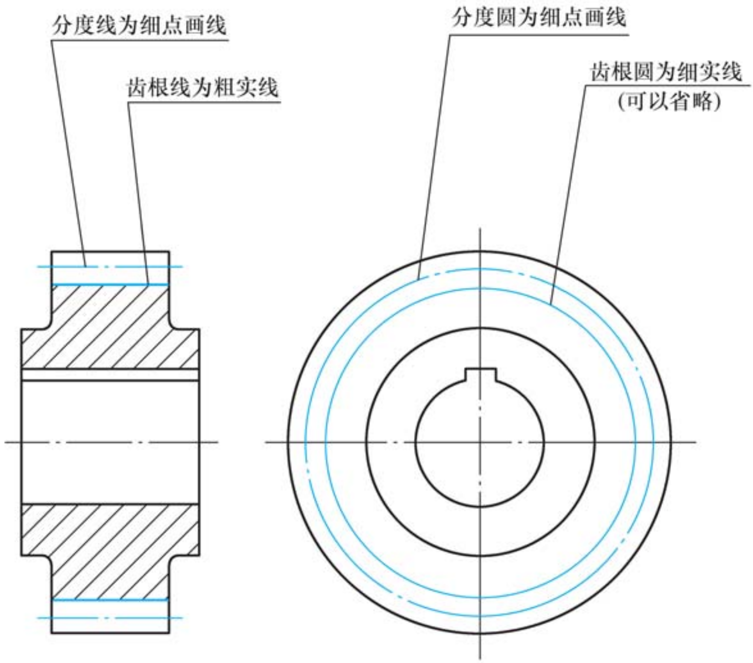
例 6-23　分析滚动轴承画法的正误



a) 正　　b) 误

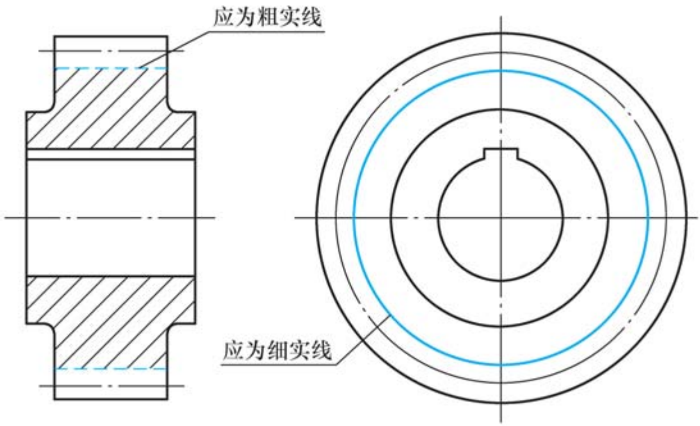
6.7　齿轮

例 6-24　分析圆柱直齿轮画法的正误

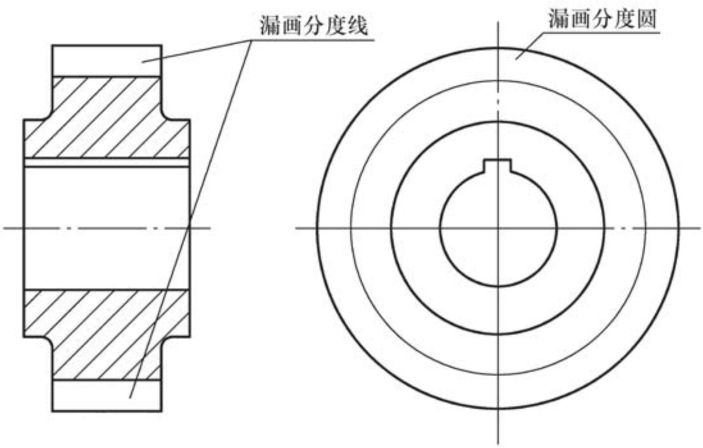


a) 正

扫码看视频讲解

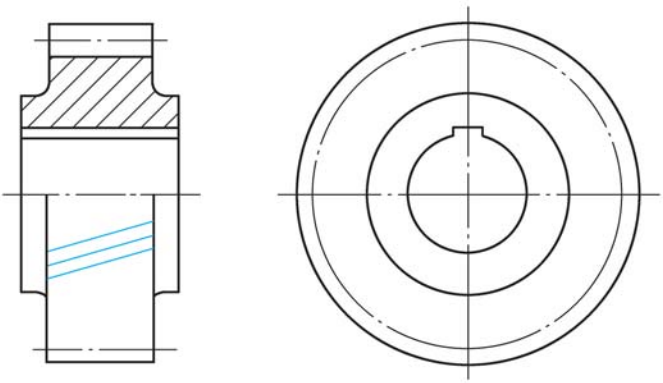


b) 误

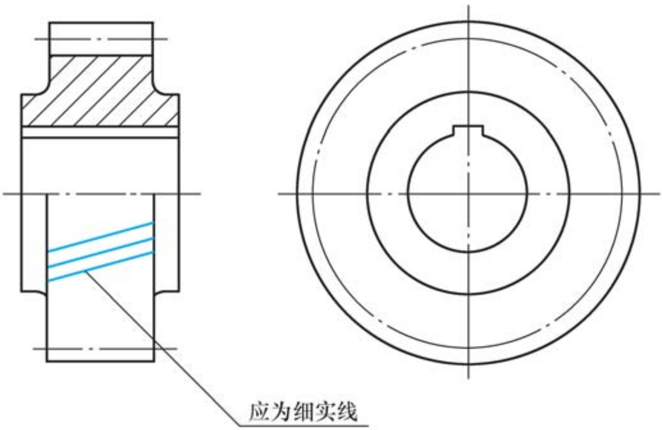


c) 误

例 6-25　分析圆柱斜齿轮画法的正误



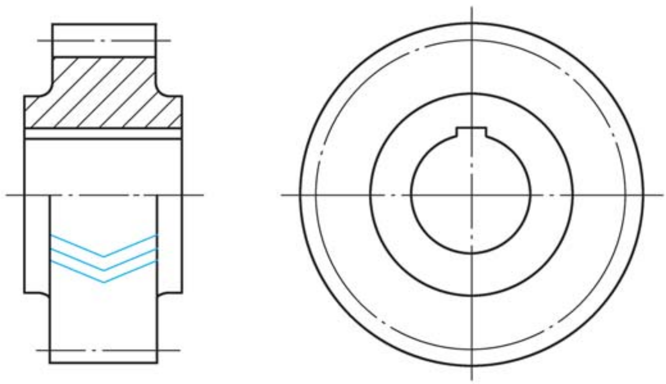
a) 正



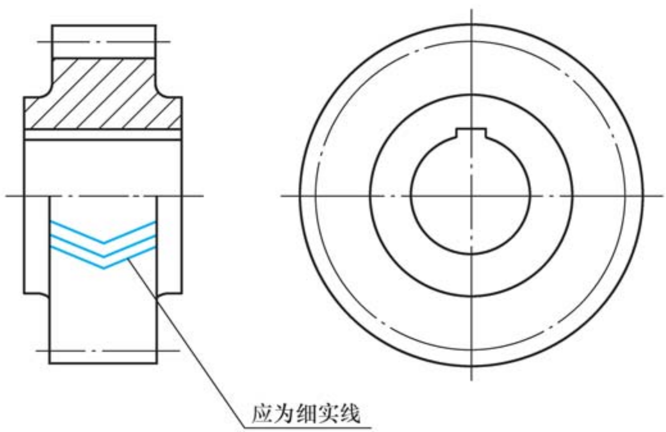
b) 误

扫码看视频讲解

例 6-26　分析圆柱人字齿轮画法的正误

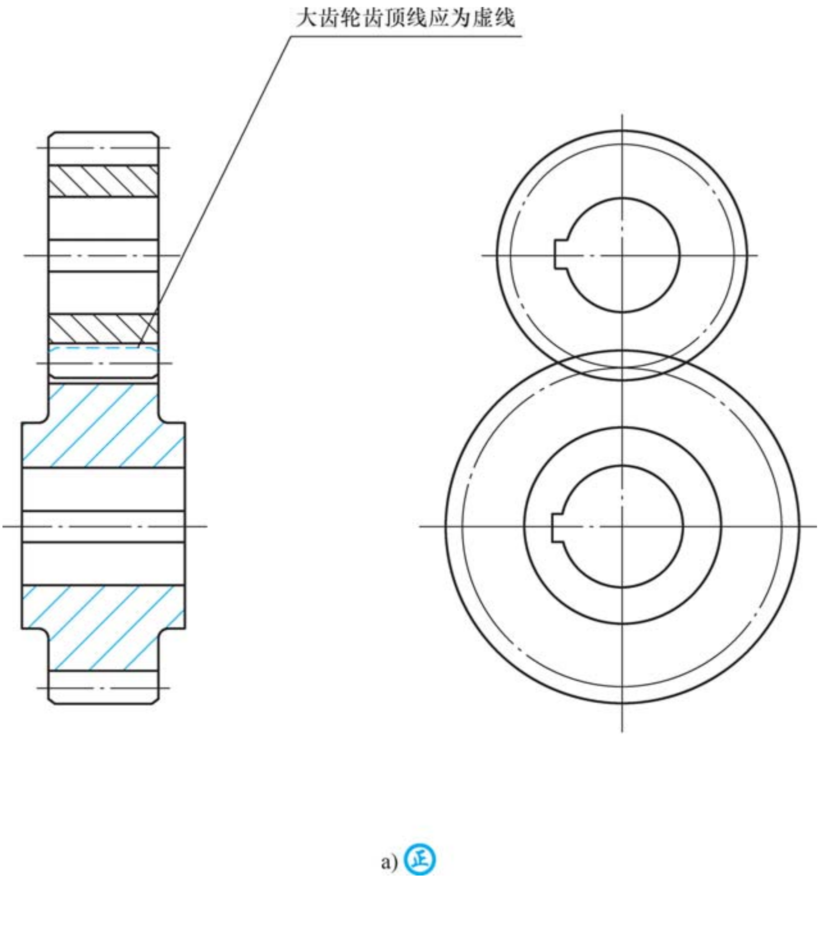


a) 正

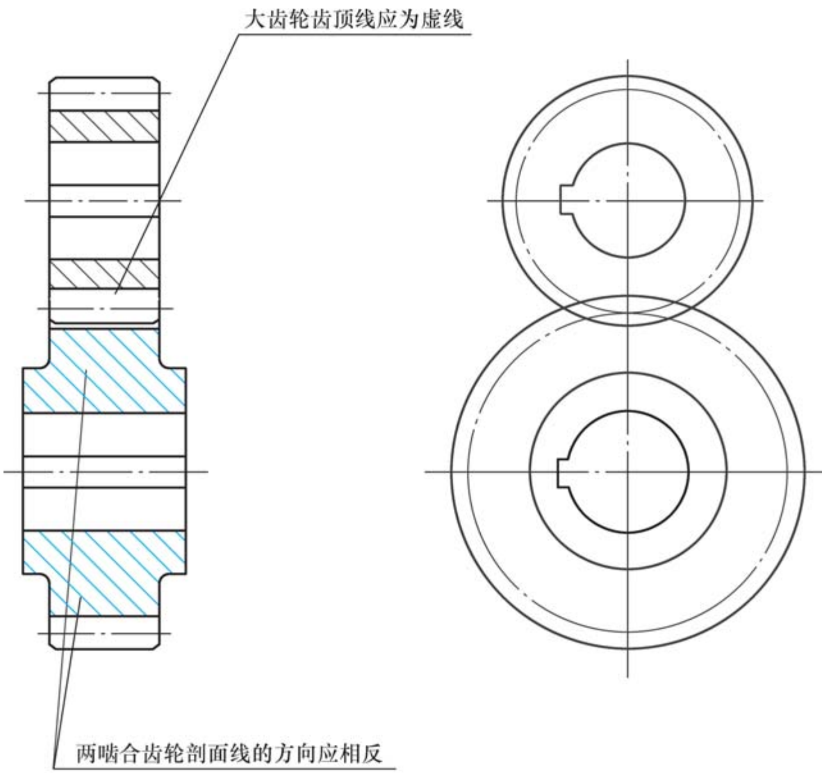


b) 误

例 6-27　分析圆柱齿轮副啮合画法的正误



a) 正

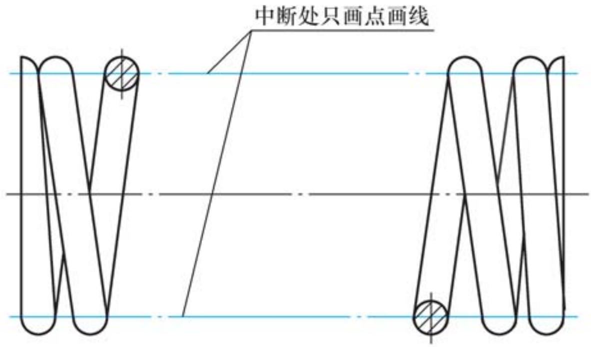


b) 误

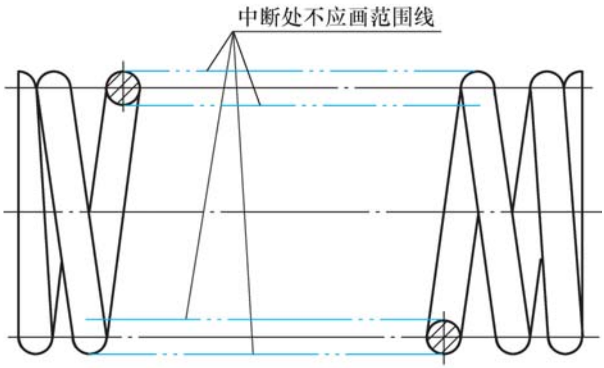

扫码看视频讲解

6.8 弹簧

例 6-28 分析圆柱螺旋弹簧画法的正误

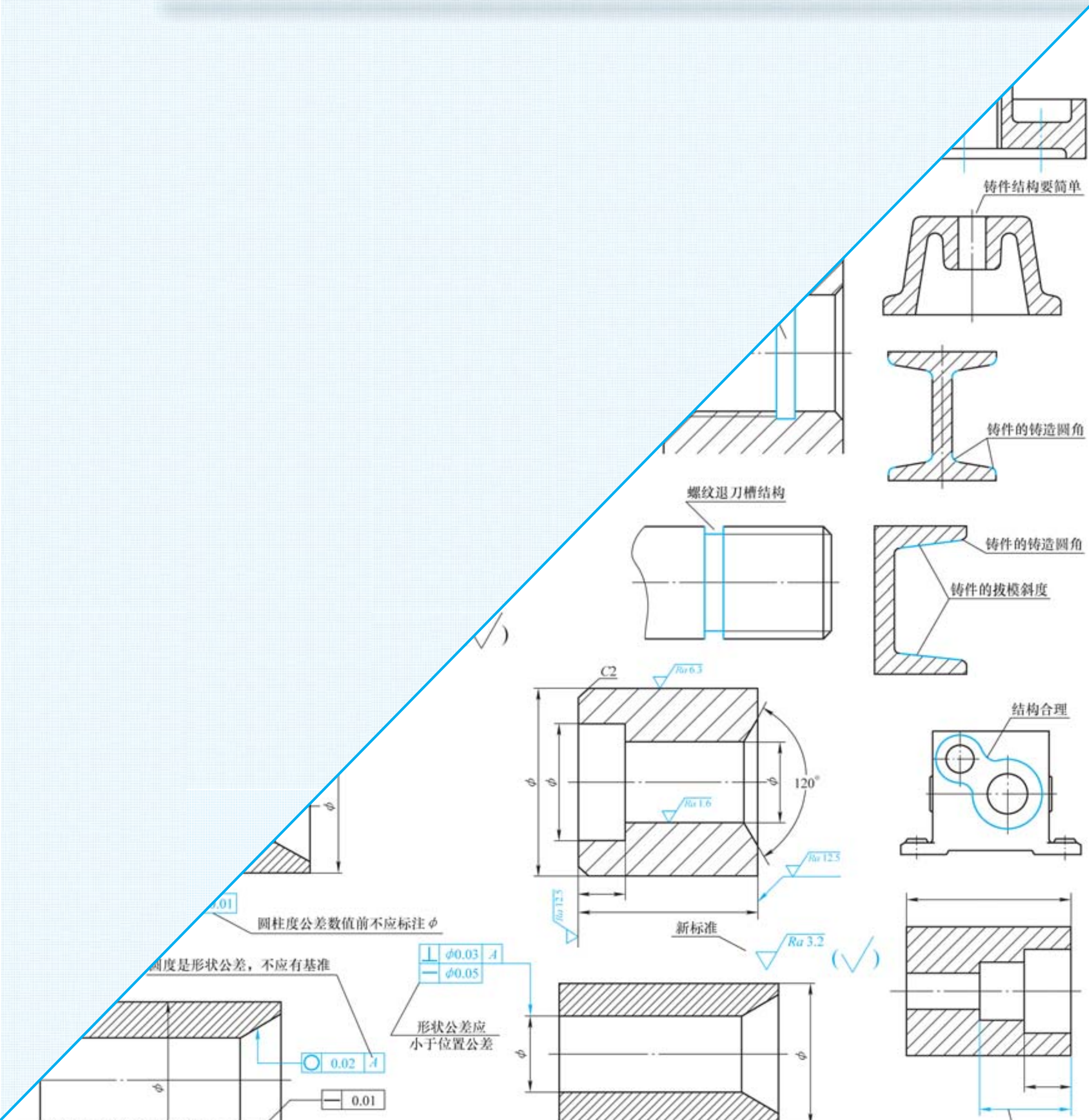


a) 正



b) 误

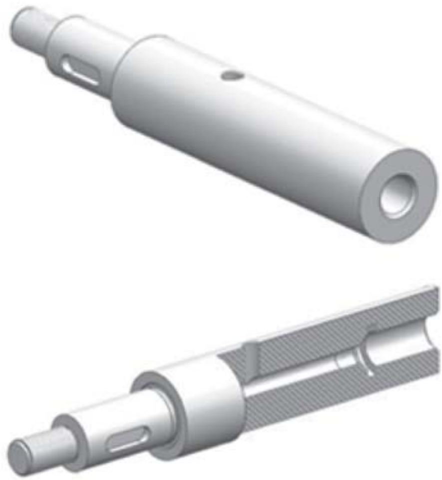
第 7 章 零件图



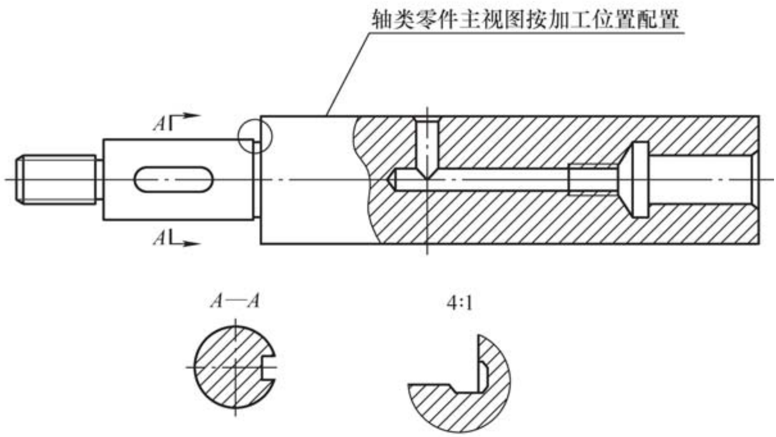
铸件结构要简单
铸件的铸造圆角
螺纹退刀槽结构
铸件的铸造圆角
铸件的拔模斜度
C2
120°
结构合理
新标准
Ra 3.2
(√)
圆柱度公差数值前不应标注 ϕ
度是形状公差，不应有基准
ϕ0.03
A
ϕ0.05
形状公差应
小于位置公差
0.02
A
0.01

7.1 零件图的视图选择

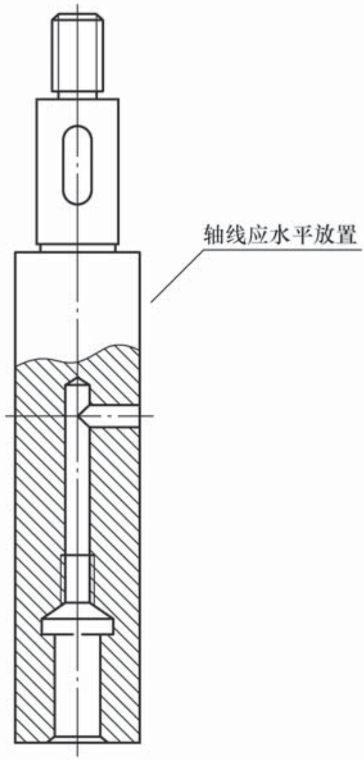
例 7-1 分析轴套类零件主视图选择的正误



a) 立体图



b) 正

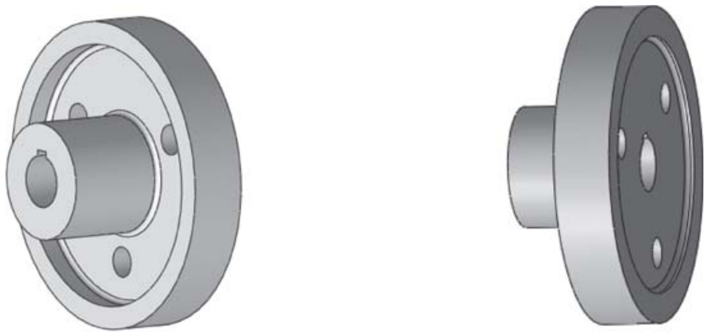


c) 误

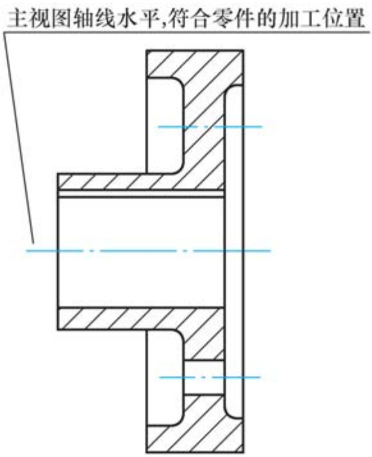
说明

轴类零件的主要结构是共轴线的回转体。轴类零件的加工主要在车床上完成，因此，主视图应与零件在车床上的加工位置一致，即将它们水平放置，轴线水平。

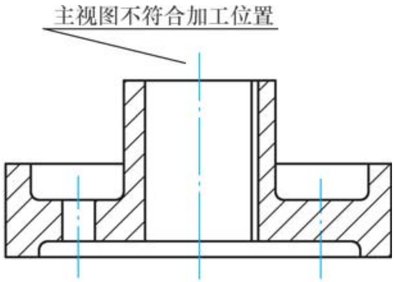
例 7-2　分析盘盖类零件主视图选择的正误



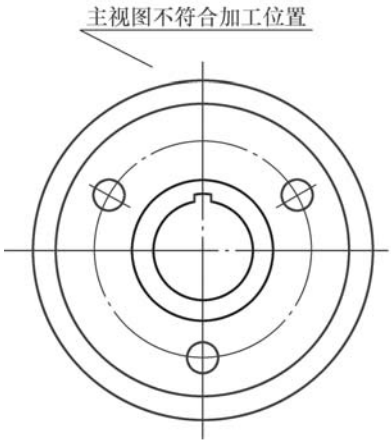
a) 立体图



b) 正



c) 误

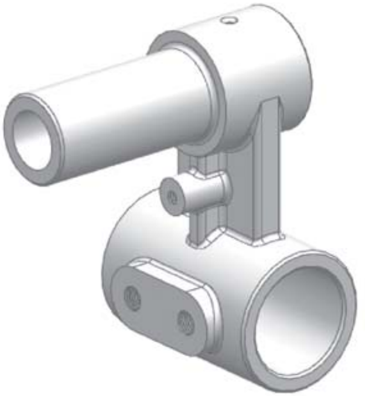


d) 误

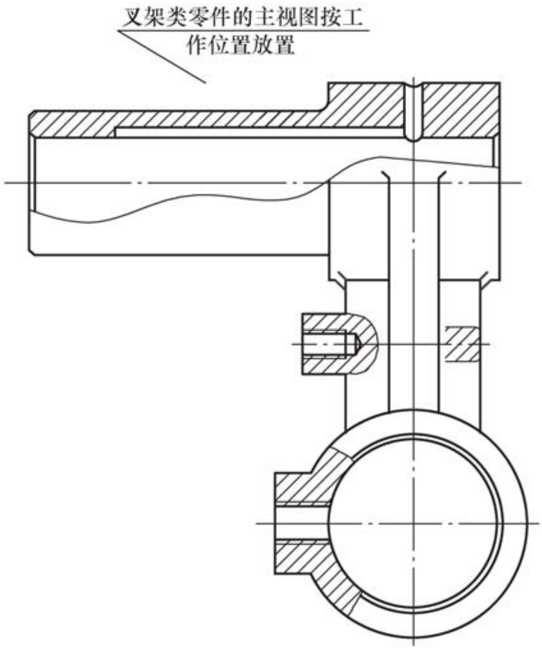
说明

盘盖类零件主要包括各种手轮、带轮、法兰盘及端盖等。它们的主要结构特征通常也是共轴线的回转体，但长度较短。盘类零件的主视图也应按加工位置选择，将轴水平放置。

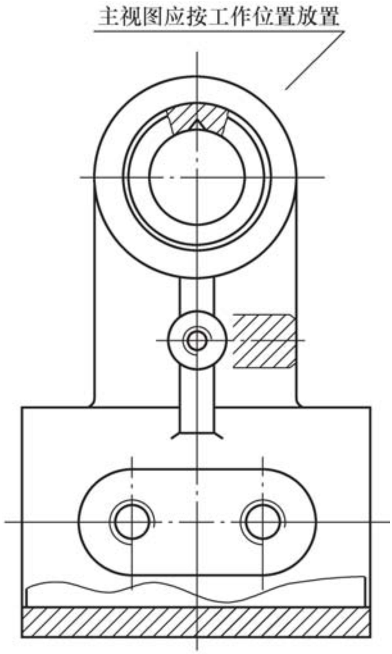
例 7-3　分析十字接头零件主视图选择的正误



a) 立体图



b) 正

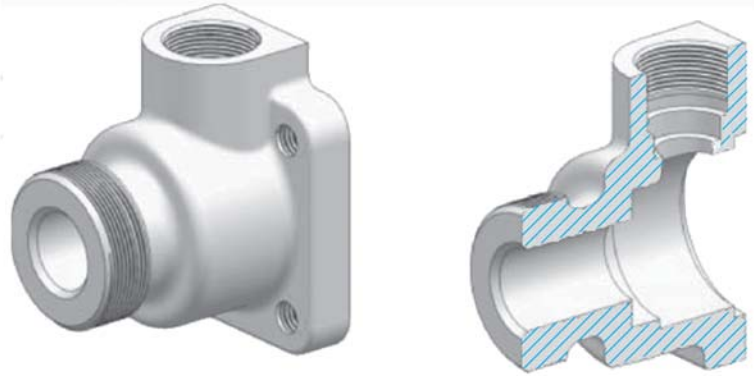


c) 误

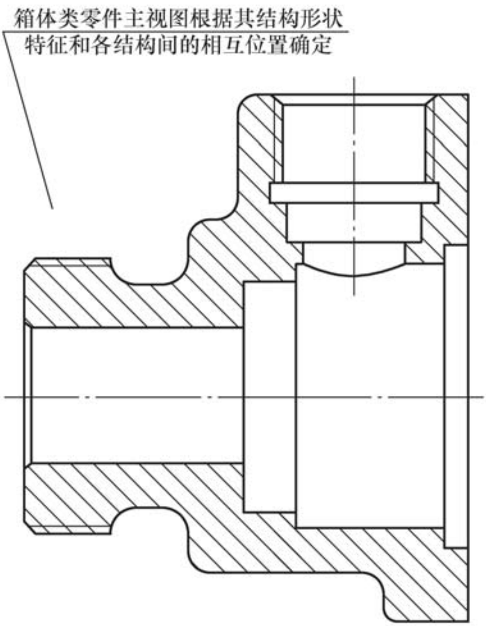
说明

叉架类零件包括拨叉、连杆、支架和支座等。叉架类零件的结构形状比较复杂，常带有倾斜和弯曲的结构，通常以其工作位置作为主视图的安放位置。

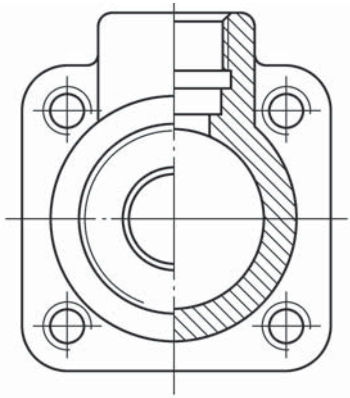
例 7-4　分析阀体零件主视图选择的正误



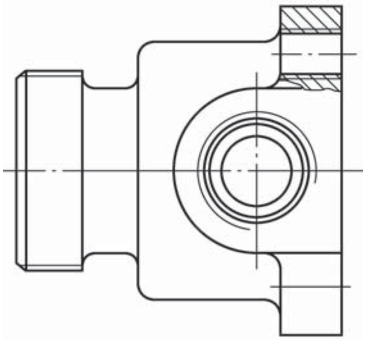
a) 立体图



b) 正



c) 误



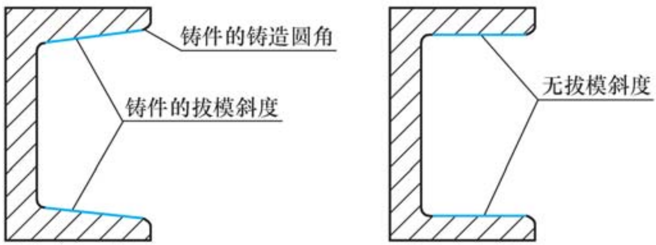
d) 误

说明

箱体类零件包括机座、箱体和机壳等。箱体类零件的结构一般比较复杂，加工工序较多，零件在不同的加工工序中被装夹的位置也不同，因此箱体类零件主视图的选择一般要考虑零件的主要结构形状特征及各结构间的相互位置关系。

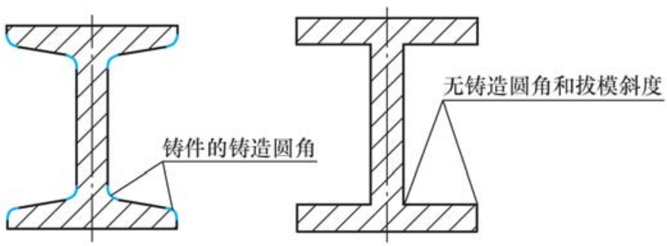
7.2 零件铸造结构的要求

例 7-5 分析零件铸造结构表达的正误



a) 正　　b) 误

例 7-6 分析零件铸造结构表达的正误

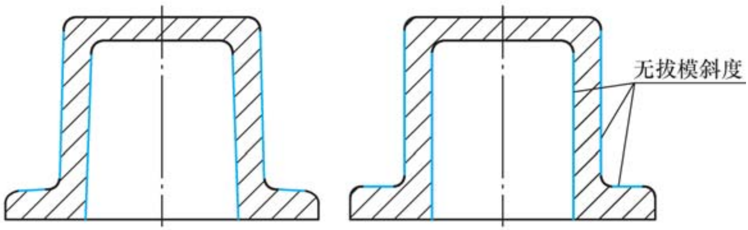


a) 正　　b) 误

说明

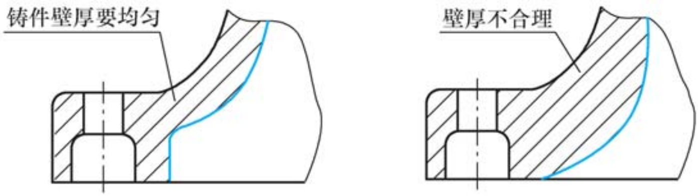
铸件在造型时，为了便于从砂型中取出木模，应在铸件沿着起模方向的内、外壁上设有一定的倾斜度，即拔模斜度。

例 7-7　分析零件铸造结构表达的正误



a) 正　　b) 误

例 7-8　分析零件铸造结构表达的正误



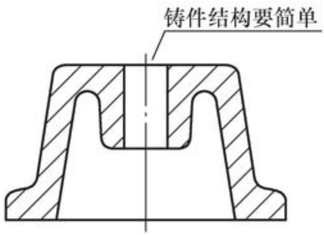
a) 正　　b) 误

说明

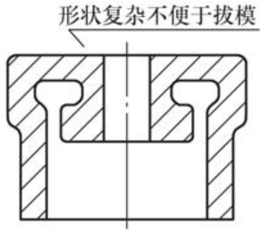
1. 为了便于取模，防止浇注时金属液冲坏砂型以及避免铸件冷却时转角处产生裂纹，铸件各表面的相交处均应制成圆弧面。图中的圆角称为铸造圆角。

2. 为了使金属液冷却速度均匀，要求铸件的壁厚尽量一致。

例 7-9　分析零件铸造结构表达的正误

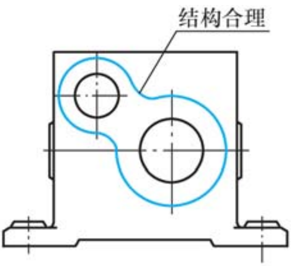


a) 正

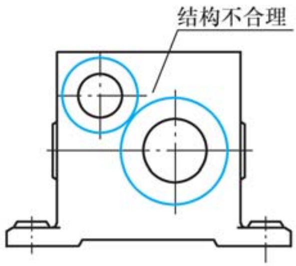


b) 误

例 7-10　分析零件铸造结构表达的正误



a) 正



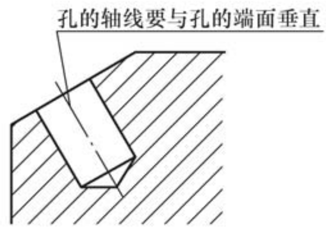
b) 误

说明

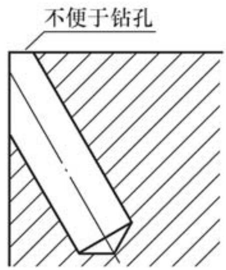
铸件在造型时，为了便于取模，在满足功能的前题下应尽量使其结构简单。

7.3　零件切削加工结构的要求

例 7-11　分析零件钻孔结构表达的正误

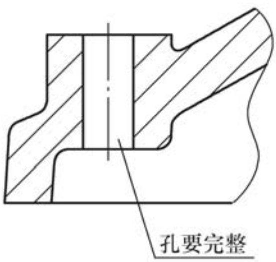


a) 正

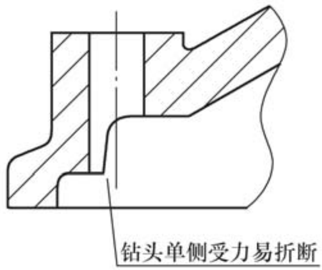


b) 误

例 7-12　分析零件钻孔结构表达的正误

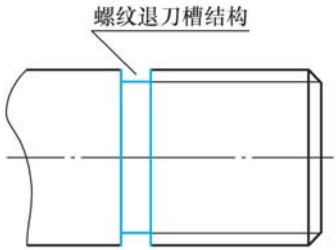


a) 正

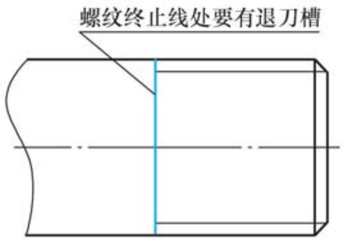


b) 误

例 7-13　分析螺纹退刀槽结构表达的正误



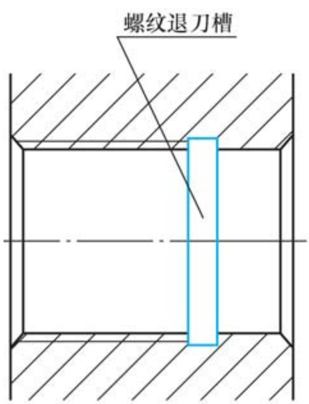
a) 正



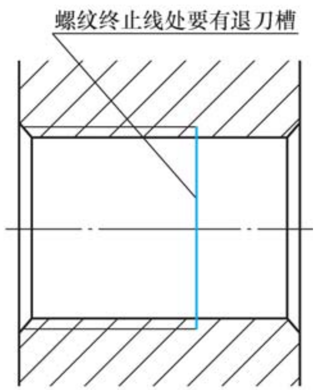
b) 误

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例 7-14　分析螺纹退刀槽结构表达的正误

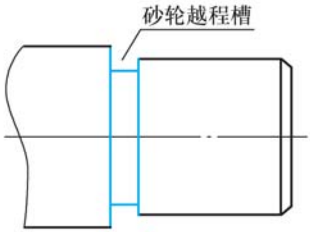


a) 正

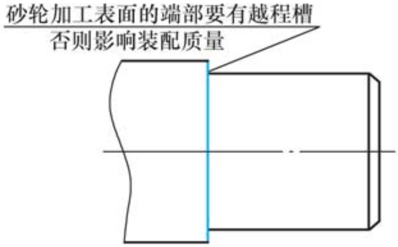


b) 误

例 7-15　分析砂轮越程槽结构表达的正误

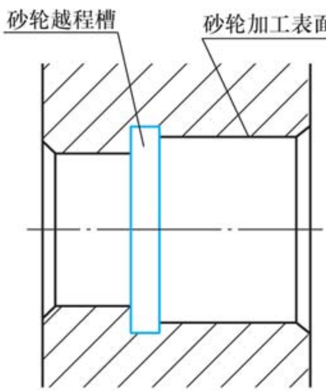


a) 正

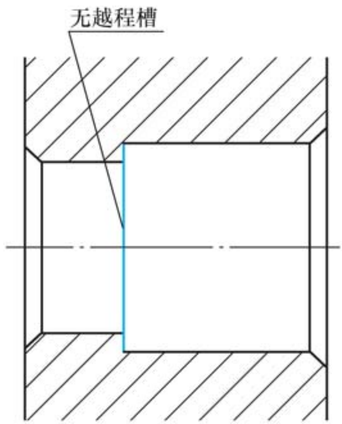


b) 误

例 7-16　分析砂轮越程槽结构表达的正误



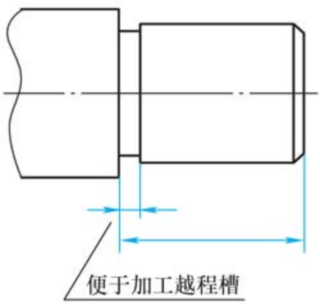
a) 正



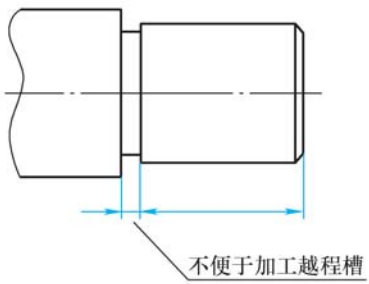
b) 误

7.4　零件图的尺寸标注

例 7-17　分析零件尺寸标注的正误

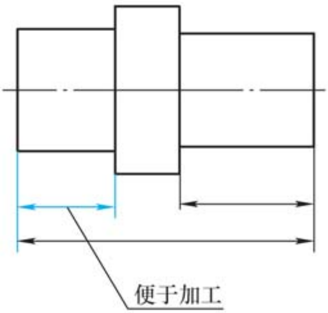


a) 正

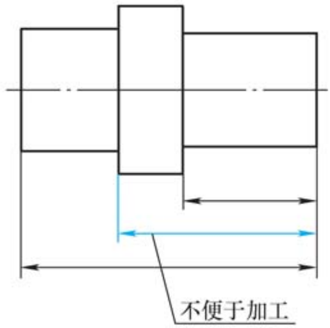


b) 误

例 7-18　分析零件尺寸标注的正误

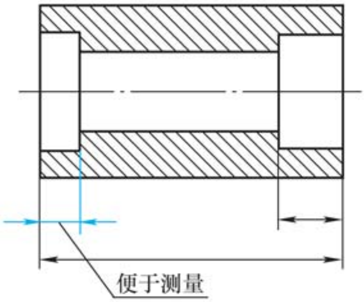


a) 正

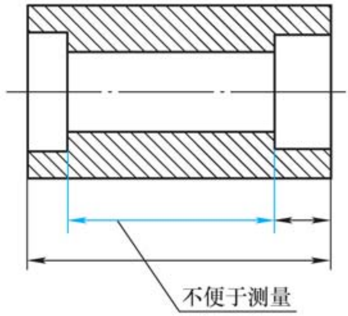


b) 误

例 7-19　分析零件尺寸标注的正误

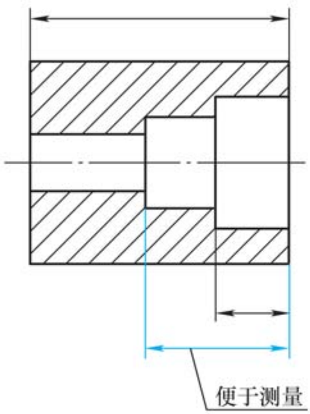


a) 正

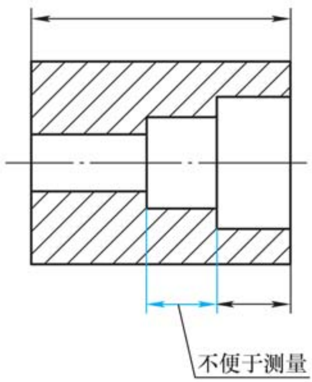


b) 误

例 7-20　分析零件尺寸标注的正误

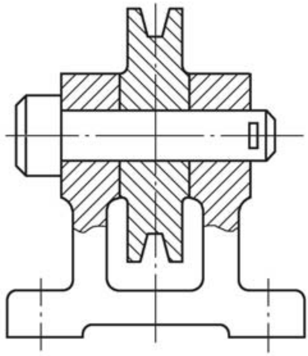


a) 正

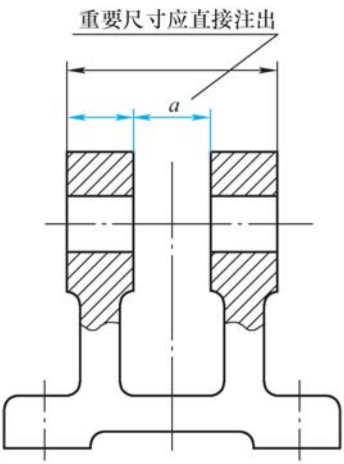


b) 误

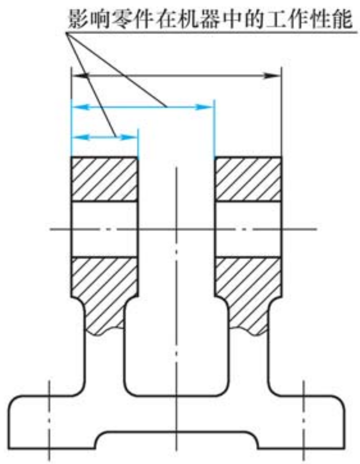
例 7-21　分析零件尺寸标注的正误



a) 视图

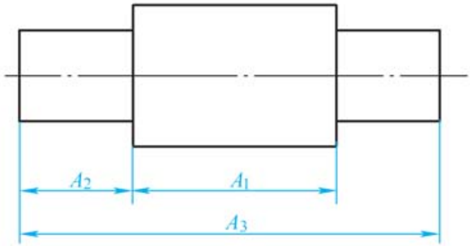


b) 正



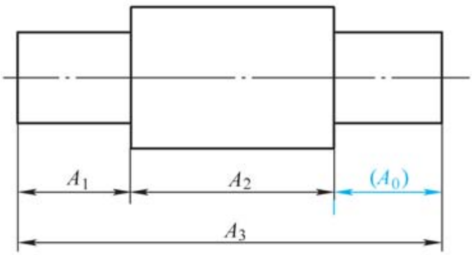
c) 误

例 7-22　分析零件尺寸标注的正误

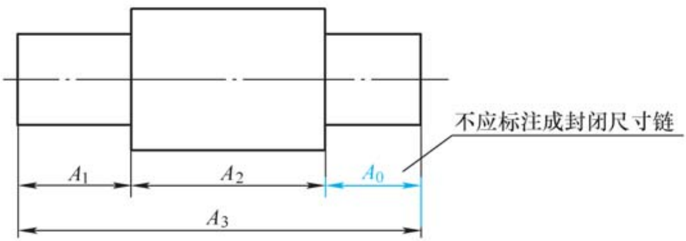


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a) 正

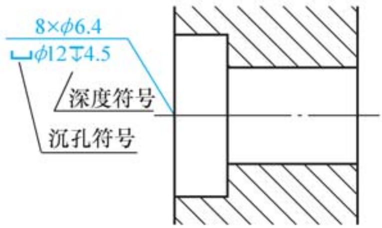


b) 正

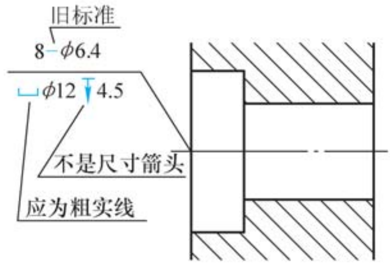


c) 误

例 7-23　分析零件孔结构尺寸标注的正误

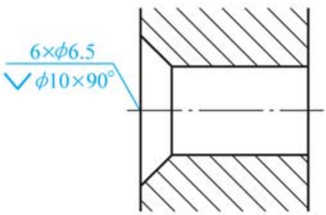


a) 正

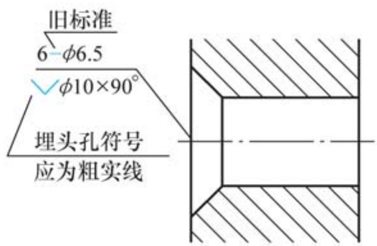


b) 误

例 7-24　分析零件埋头孔结构尺寸标注的正误

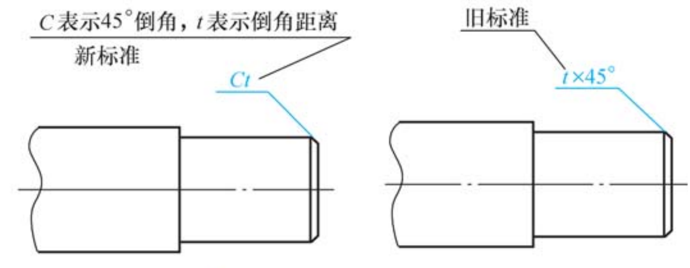


a) 正



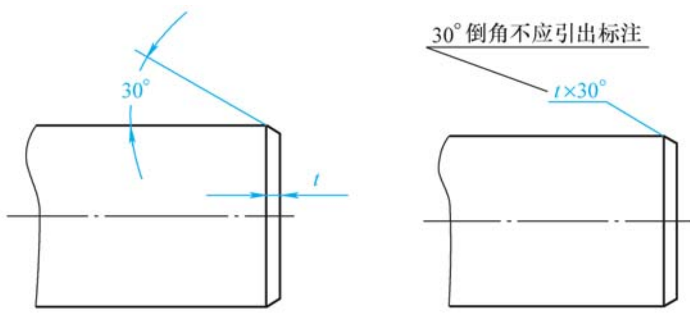
b) 误

例 7-25 分析零件倒角结构尺寸标注的正误



a) 正 b) 误

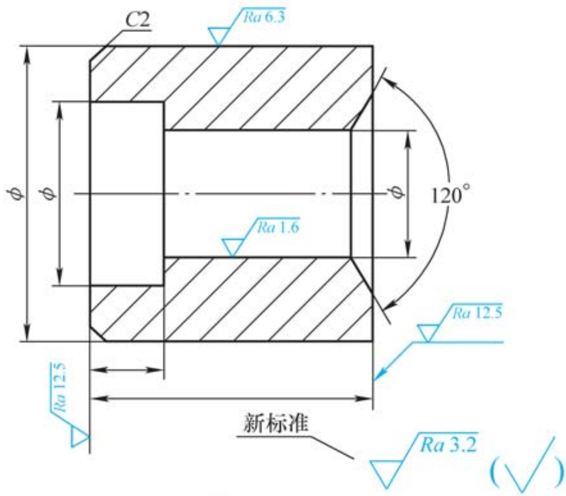
例 7-26 分析零件倒角结构尺寸标注的正误



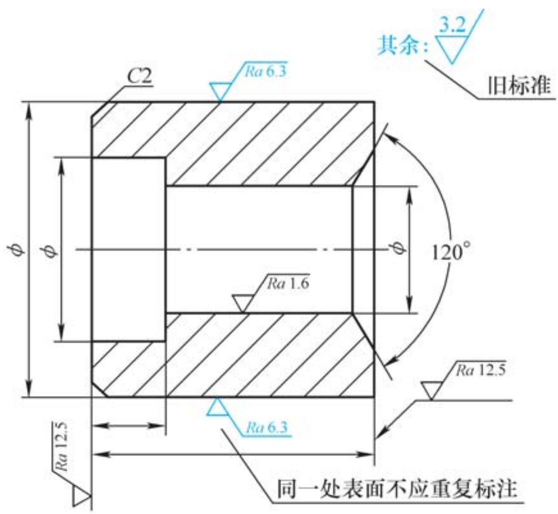
a) 正 b) 误

7.5 零件表面粗糙度要求

例 7-27 分析零件表面粗糙度标注的正误

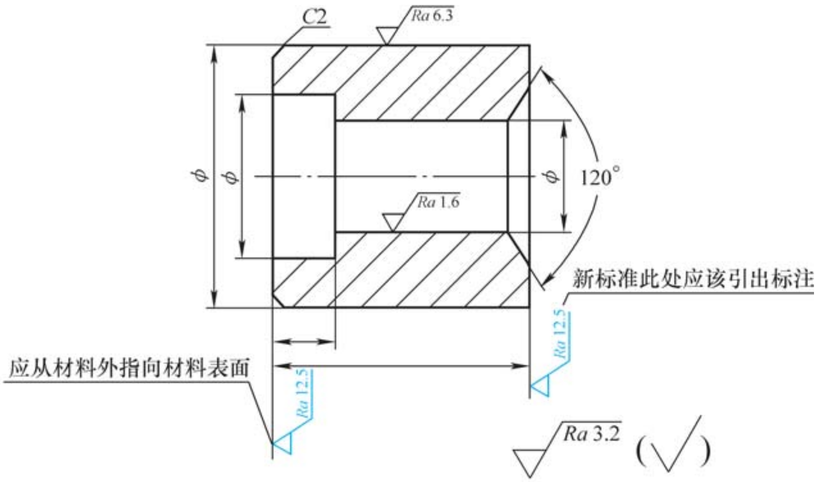


a) 正

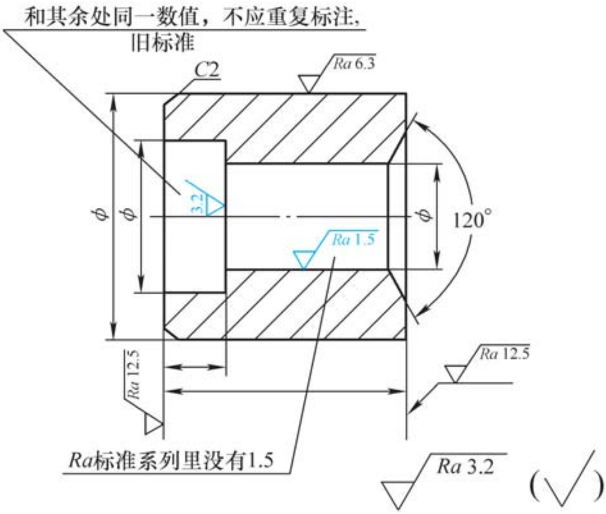


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b) 误


C2
Ra 6.3
ϕ
ϕ
ϕ
120°
Ra 1.6
新标准此处应该引出标注
Ra 12.5
应从材料外指向材料表面
Ra 12.5
Ra 3.2
(√)

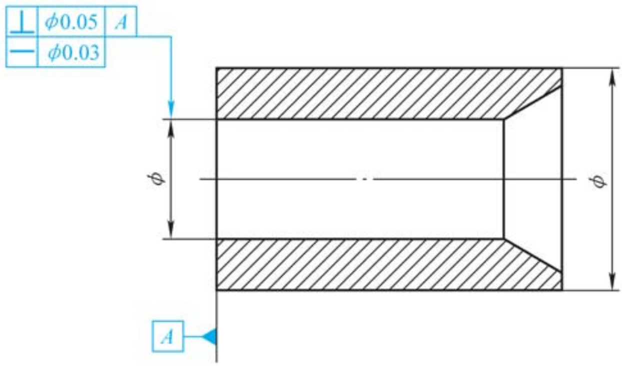
c) 误


和其余处同一数值，不应重复标注，
旧标准
C2
Ra 6.3
ϕ
ϕ
3.2
ϕ
120°
Ra 1.5
Ra 12.5
Ra 12.5
Ra标准系列里没有1.5
Ra 3.2
(√)

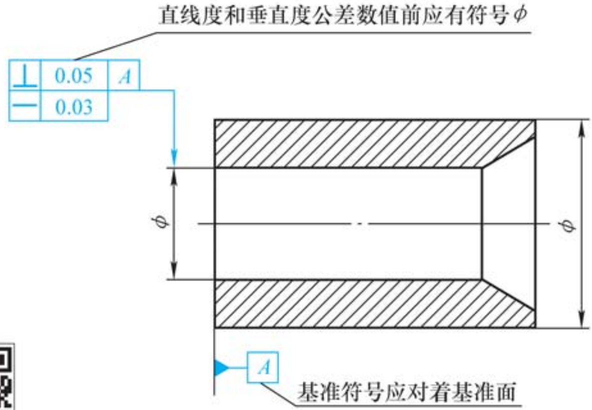
d) 误

7.6 零件几何公差要求

例 7-28 分析零件几何公差标注的正误

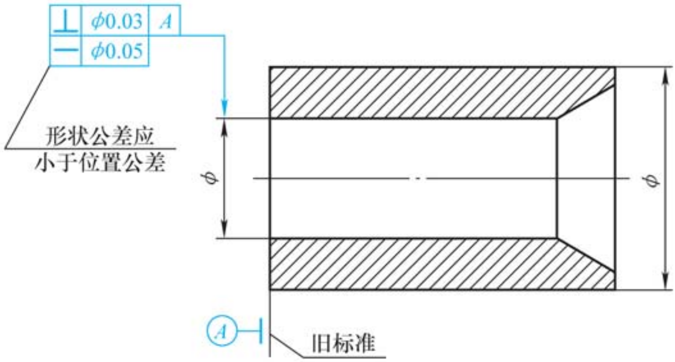


a) 正

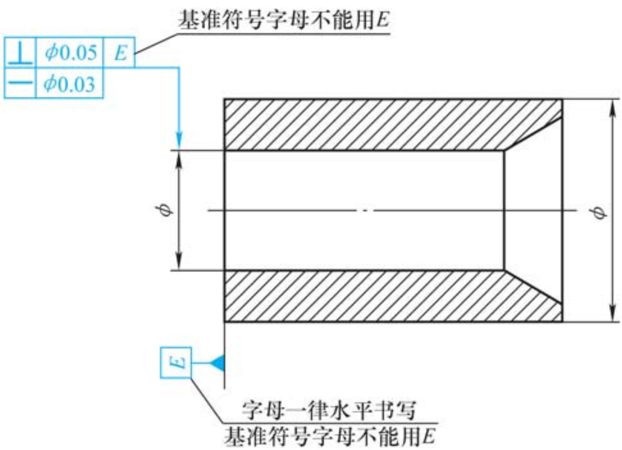


b) 误

扫码看视频讲解

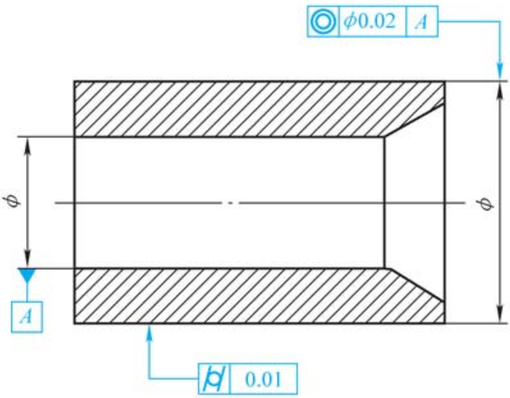

⊥ ϕ0.03 A
— ϕ0.05
形状公差应
小于位置公差
ϕ
ϕ
A
旧标准

c) 误

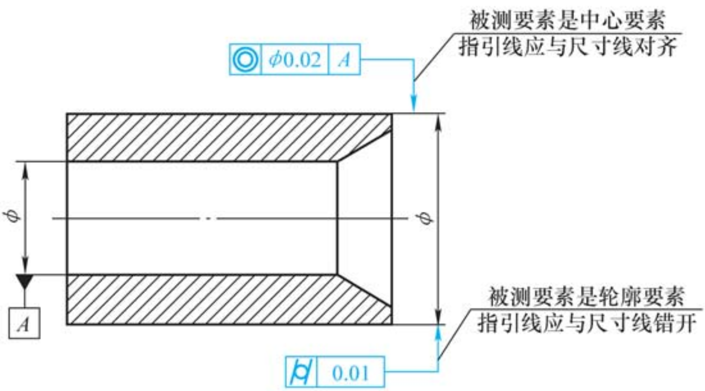

基准符号字母不能用E
⊥ ϕ0.05 E
— ϕ0.03
ϕ
ϕ
E
字母一律水平书写
基准符号字母不能用E

d) 误

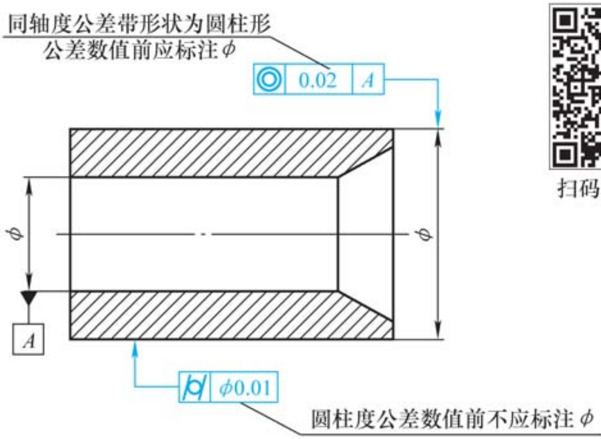
例 7-29　分析零件几何公差标注的正误



a) 正

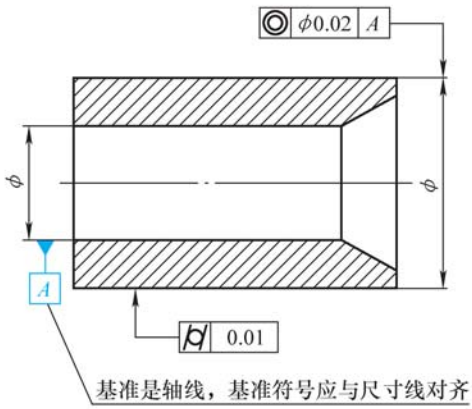


b) 误



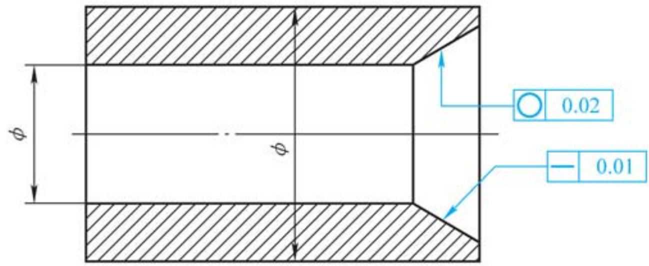
扫码看视频讲解

c) 误

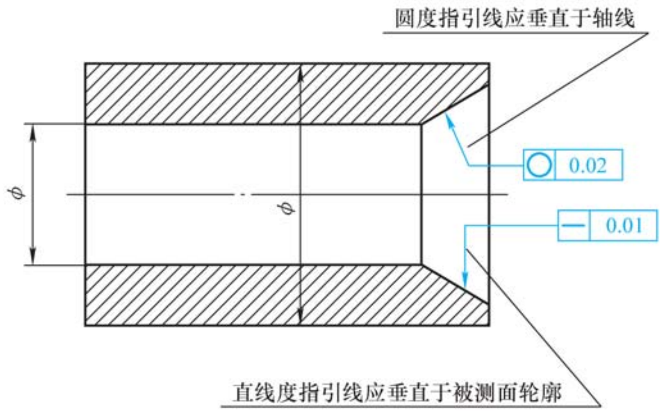


d) 误

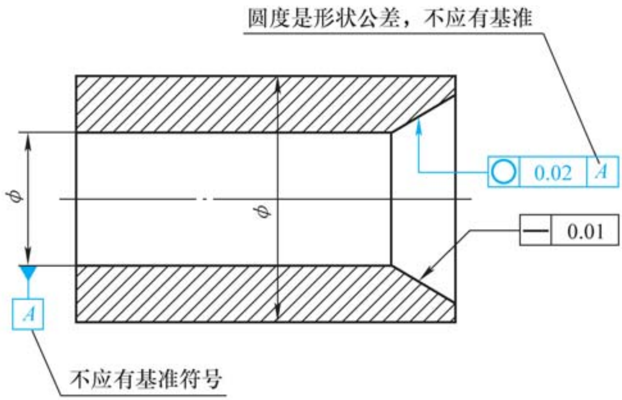
例 7-30　分析零件几何公差标注的正误



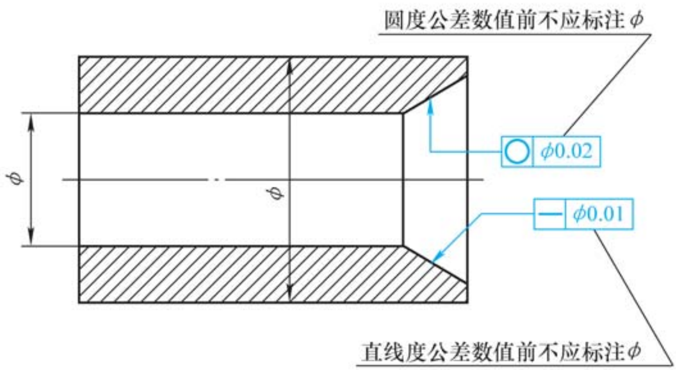
a) 正



b) 误

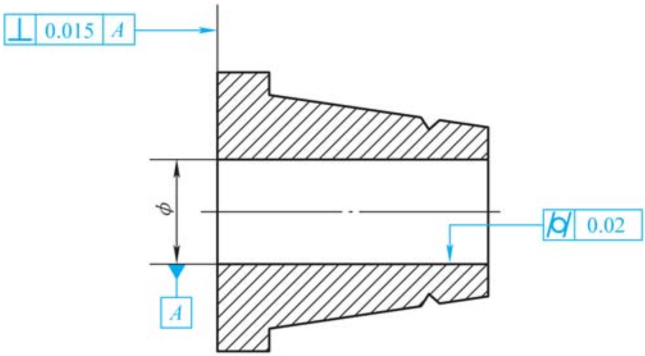

圆度是形状公差，不应有基准
0.02
A
0.01
ϕ
ϕ
A
不应有基准符号

c) 误

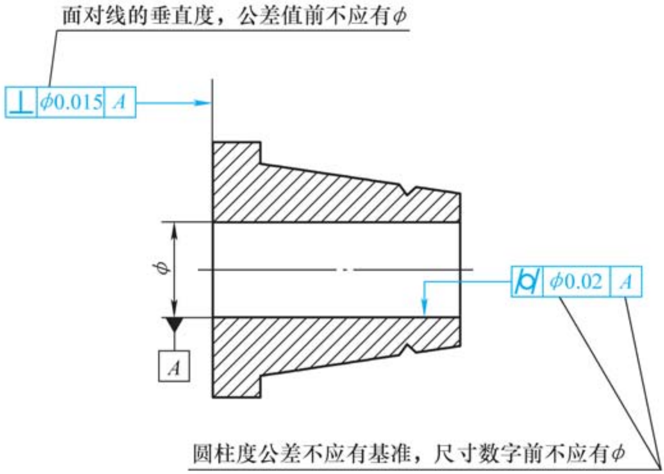

圆度公差数值前不应标注ϕ
ϕ0.02
ϕ0.01
ϕ
ϕ
直线度公差数值前不应标注ϕ

d) 误

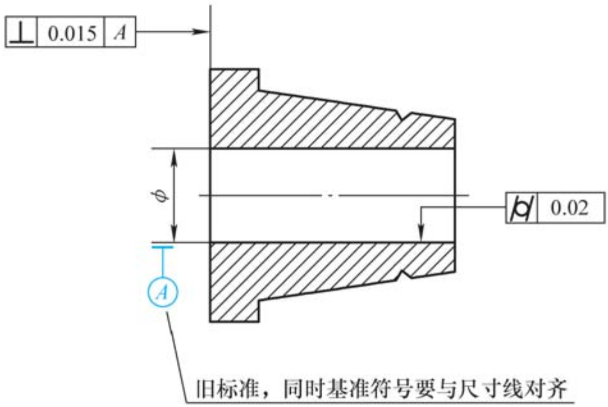
例 7-31　分析零件几何公差标注的正误



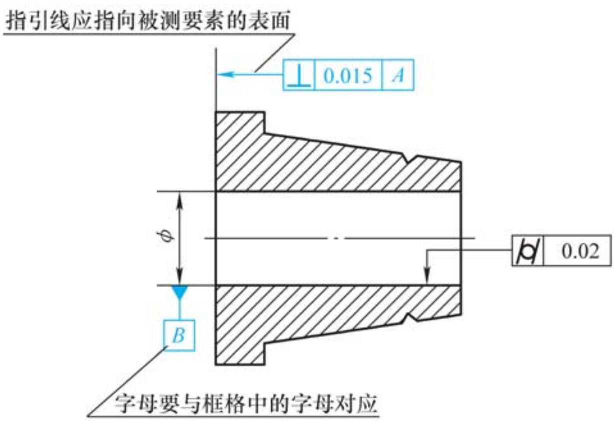
a) 正



b) 误

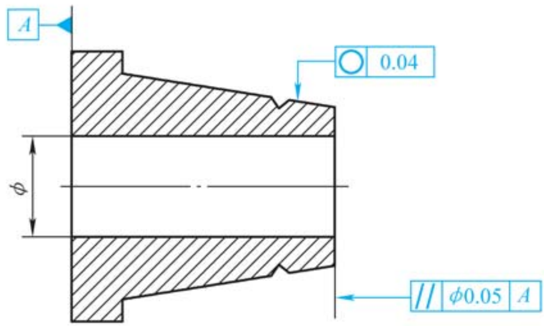

⊥ 0.015 A
ϕ
0.02
A
旧标准，同时基准符号要与尺寸线对齐

c) 误

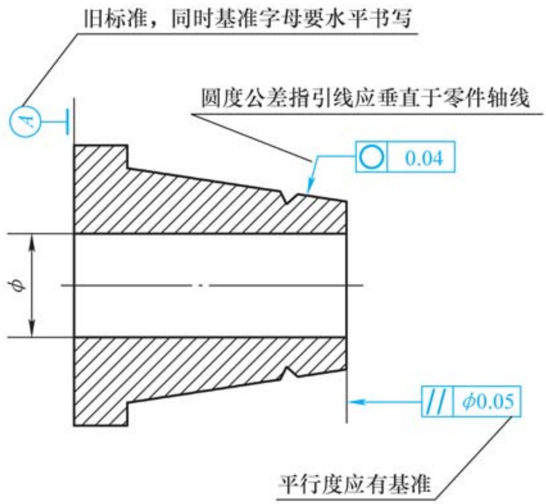

指引线应指向被测要素的表面
⊥ 0.015 A
ϕ
0.02
B
字母要与框格中的字母对应

d) 误

例 7-32　分析零件几何公差标注的正误

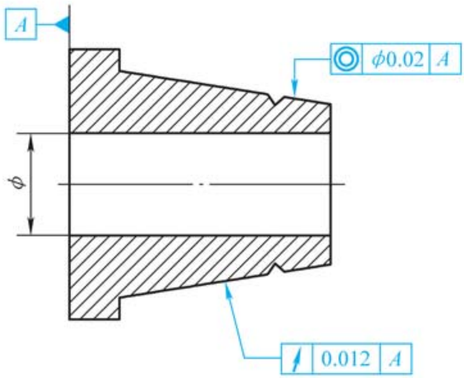


a) 正

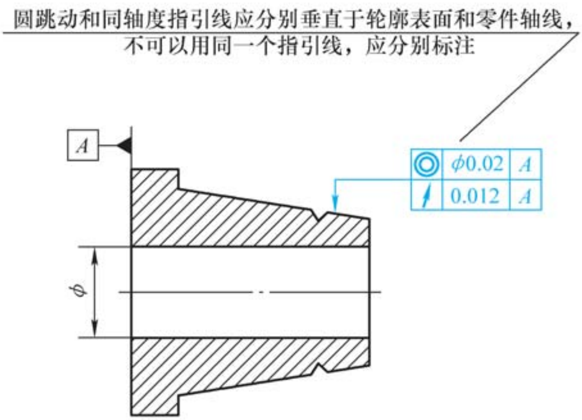


b) 误

例 7-33　分析零件几何公差标注的正误



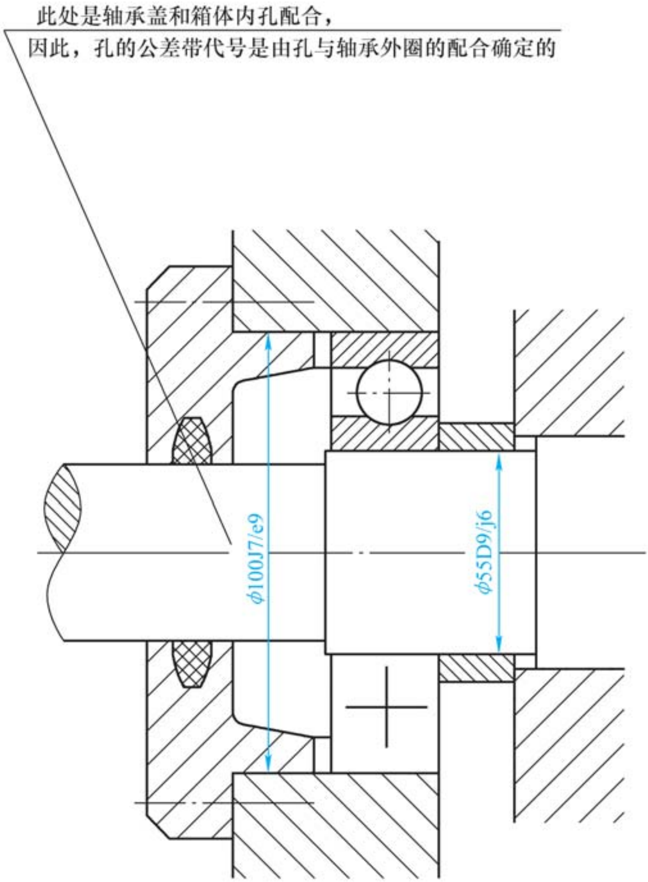
a) 正



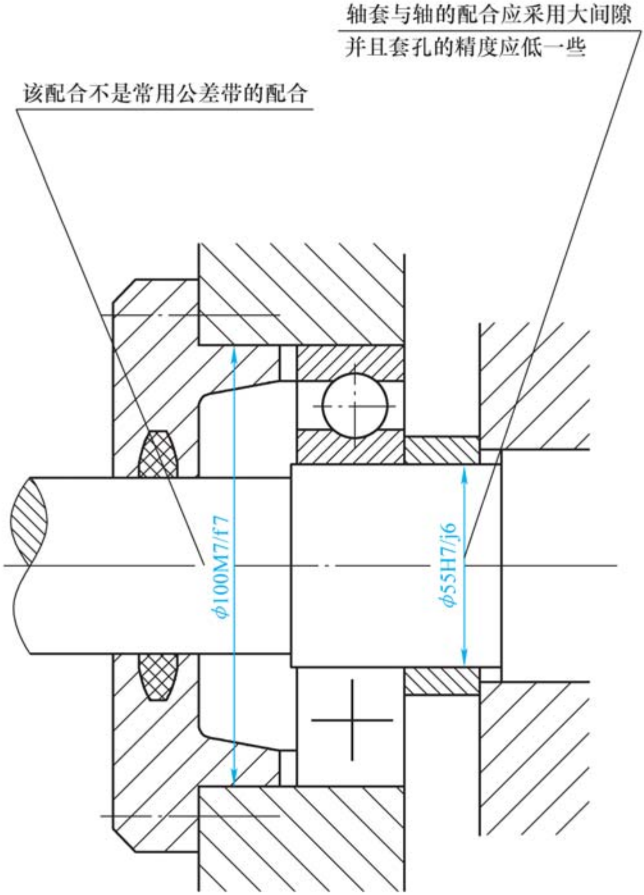
b) 误

7.7 零件极限与配合要求

例 7-34 分析零件尺寸公差标注的正误

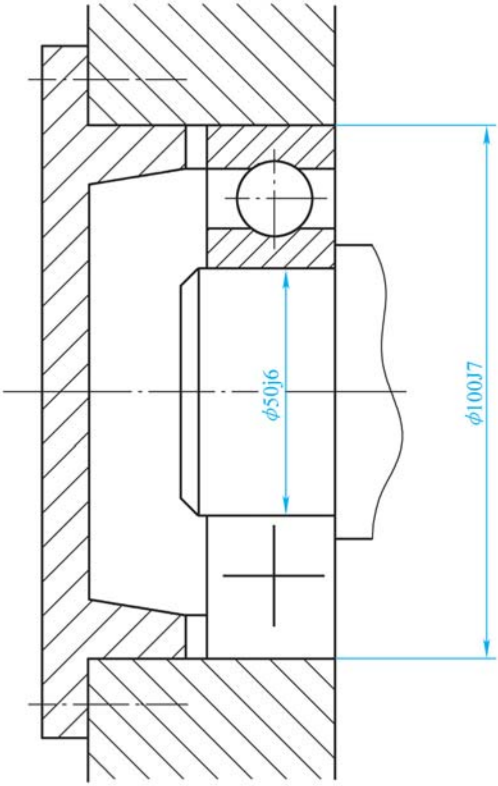


a) 正

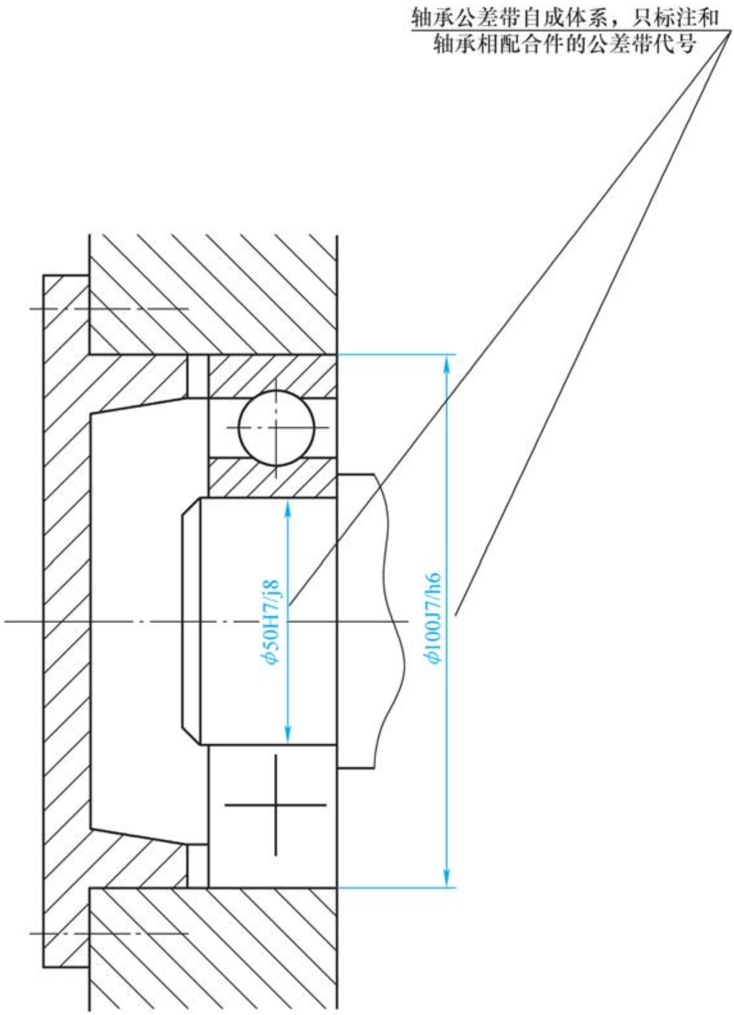

轴套与轴的配合应采用大间隙
并且套孔的精度应低一些
该配合不是常用公差带的配合
φ100M7/f7
φ55H7/j6

b) 误

例 7-35　分析零件尺寸公差标注的正误



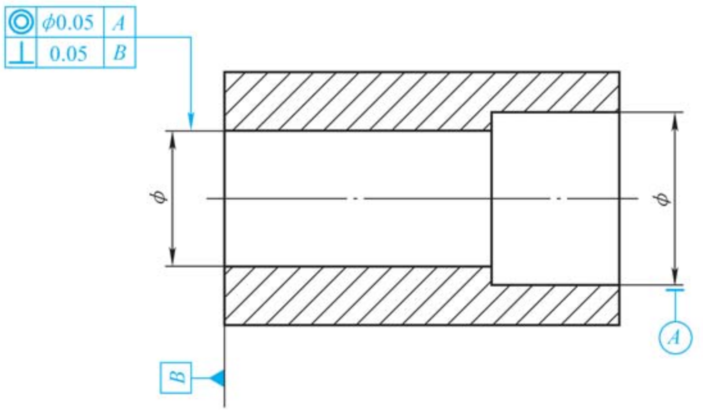
a) 正



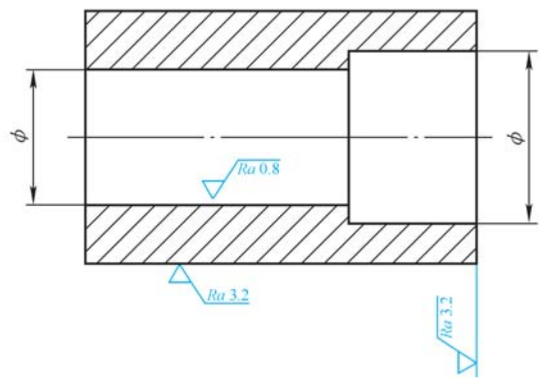
b) 误

练一练

练习 7-1　分析图中表面粗糙度和几何公差标注的正误



a)

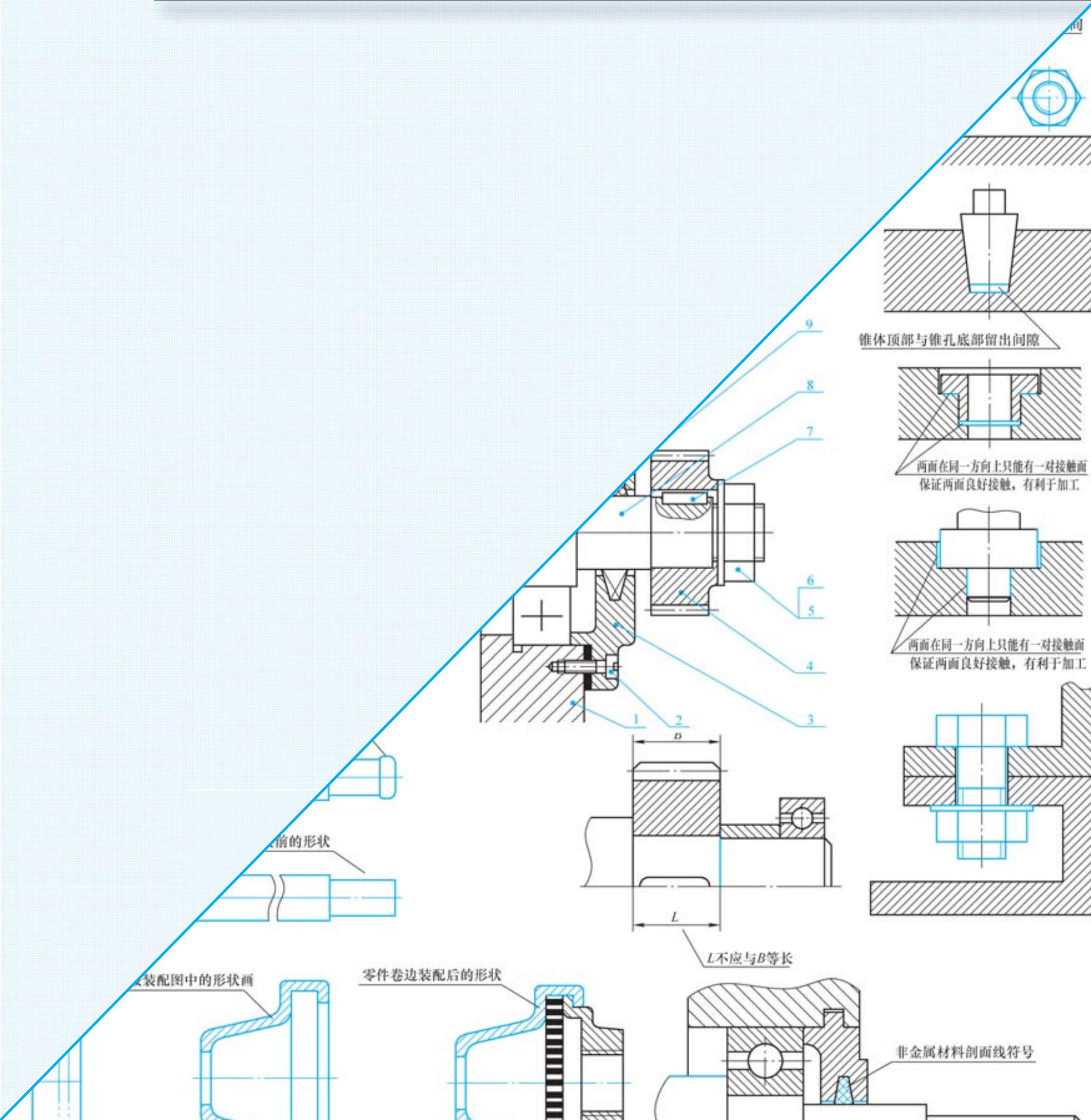


b)



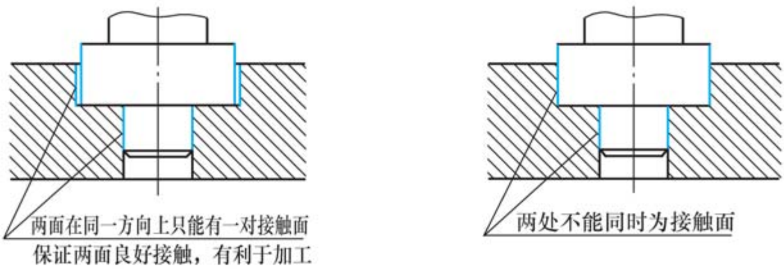
扫码看视频讲解

第 8 章 装配图


锥体顶部与锥孔底部留出间隙
两面在同一方向上只能有一对接触面
保证两面良好接触，有利于加工
两面在同一方向上只能有一对接触面
保证两面良好接触，有利于加工
L不应与B等长
零件卷边装配后的形状
非金属材料剖面线符号

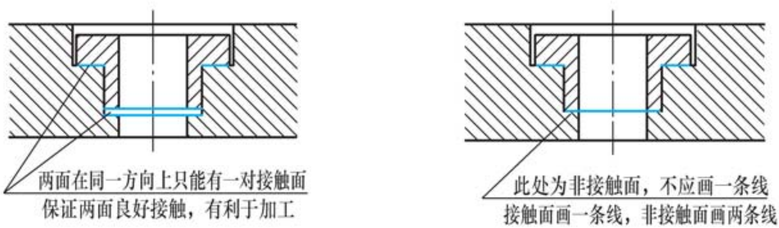
8.1 装配结构的合理性

例 8-1 分析零件装配结构的正误



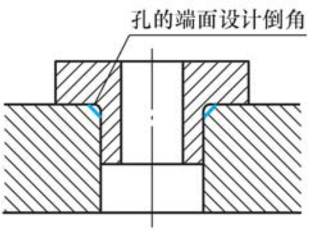
a) 正　　b) 误

例 8-2 分析零件装配结构的正误

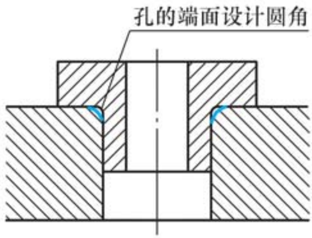


a) 正　　b) 误

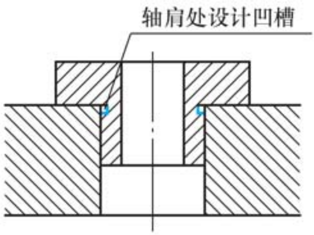
例 8-3　分析零件装配结构的正误



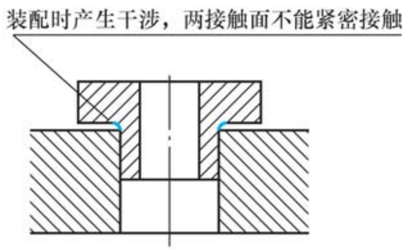
a) 正



b) 正



c) 正

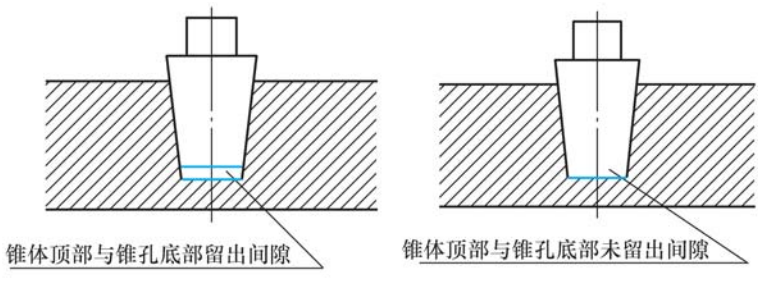


d) 误

说明

两配合零件接触面的转角处应设计倒角、圆角或凹槽，保留一定的间隙，以保证两平面紧密接触。

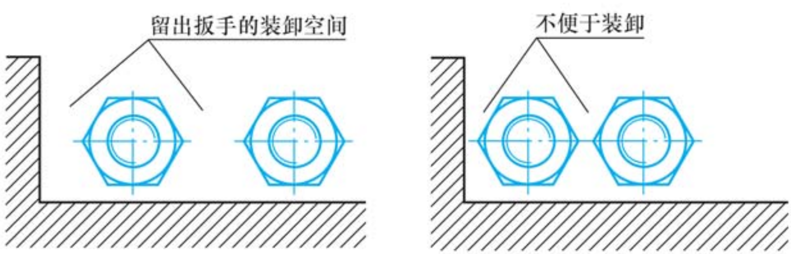
例 8-4　分析零件装配结构的误



a) 正　　　b) 误

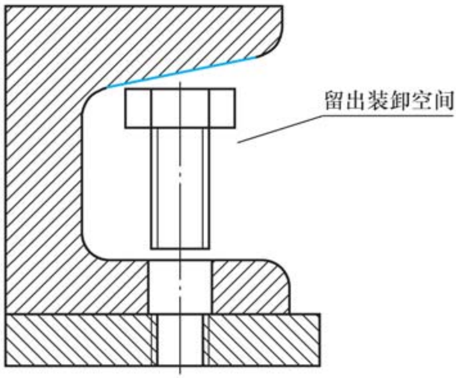
扫码看视频讲解

例 8-5　分析零件装配结构的正误

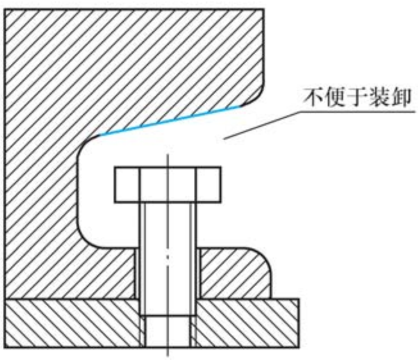


a) 正　　　b) 误

例 8-6　分析零件装配结构的正误

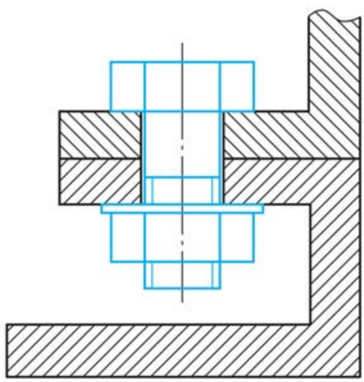


a) 正

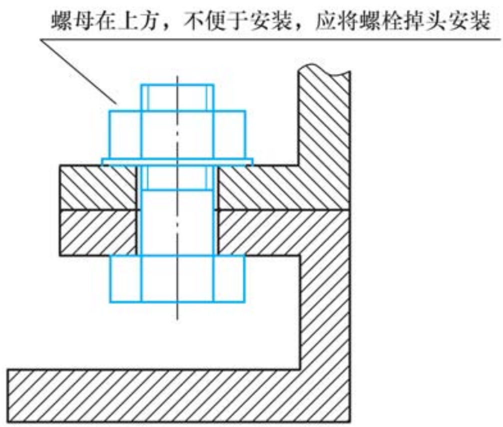


b) 误

例 8-7　分析零件装配结构的正误

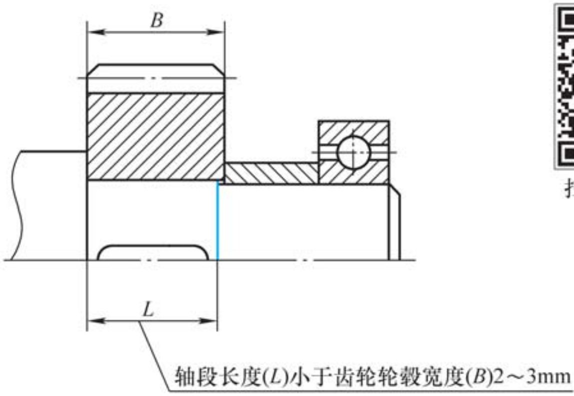


a) 正



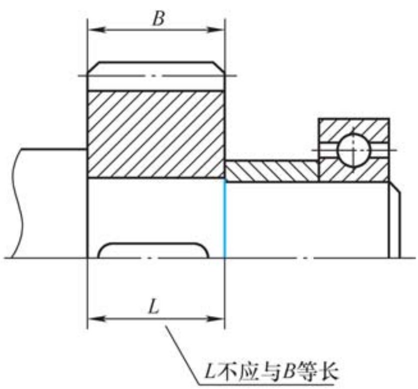
b) 误

例 8-8　分析零件装配结构的正误



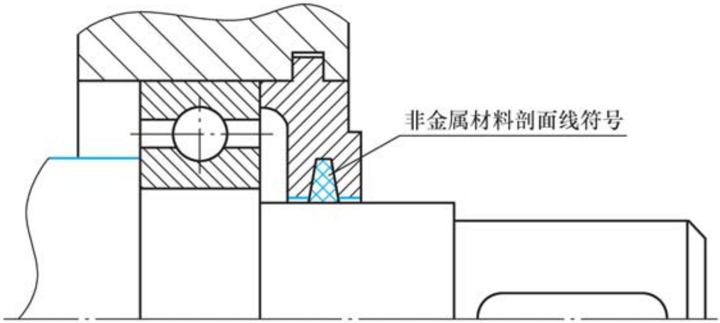
a) 正

扫码看视频讲解

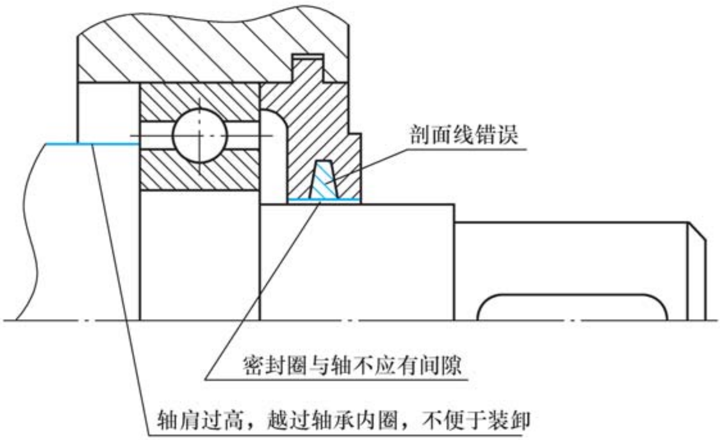


b) 误

例 8-9　分析零件装配结构的正误



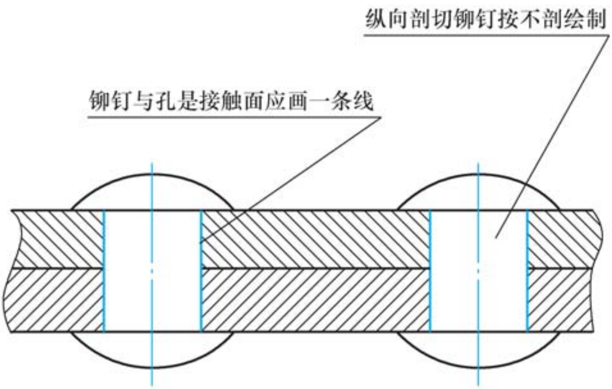
a) 正



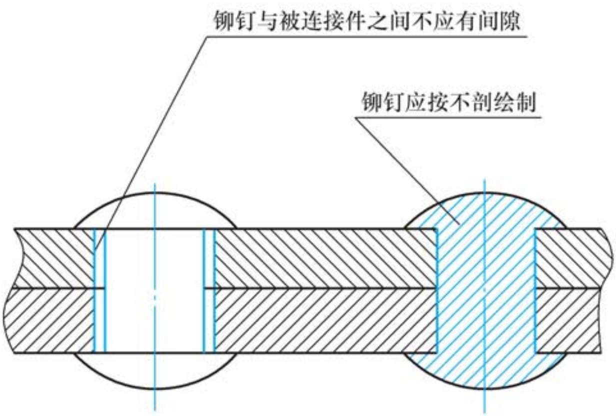
b) 误

扫码看视频讲解

例 8-10　分析铆钉连接画法的正误



a) 正

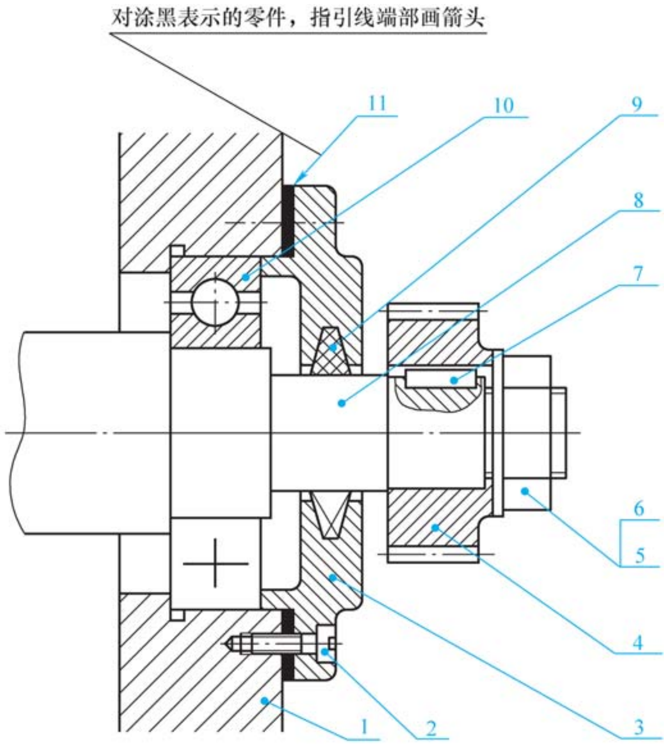


b) 误

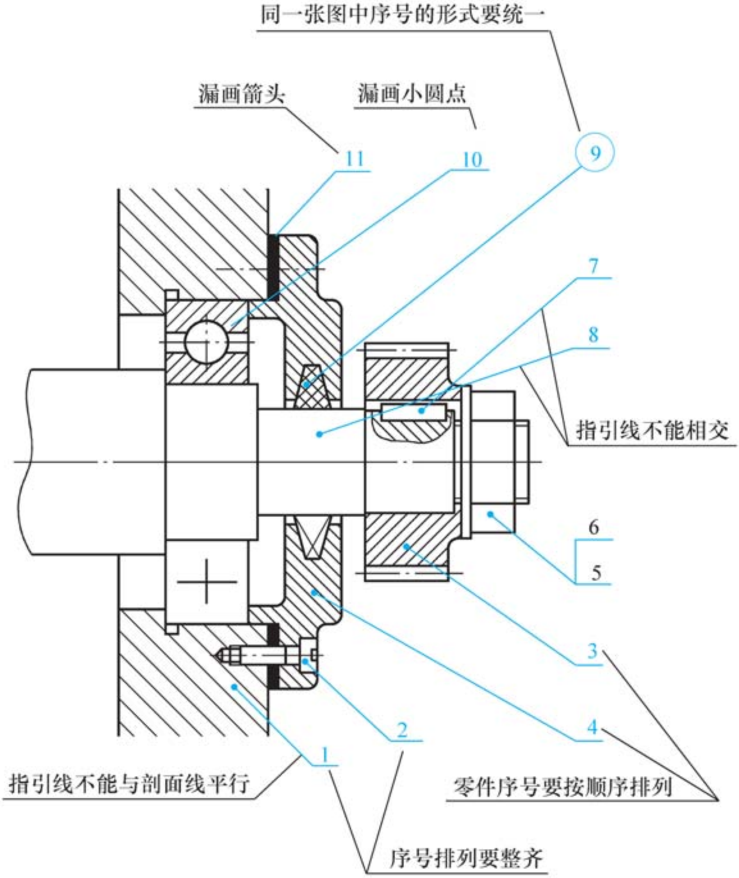
扫码看视频讲解

8.2 零部件序号和明细栏

例 8-11 分析装配图序号排列的正误



a) 正

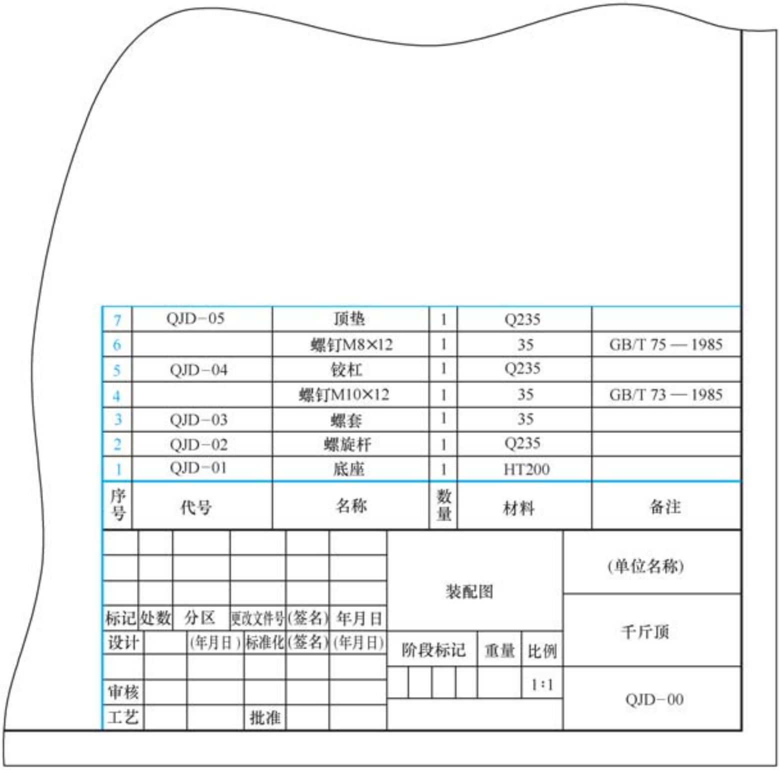

同一张图中序号的形式要统一
漏画箭头
漏画小圆点
11
10
9
7
8
指引线不能相交
6
5
3
4
2
1
指引线不能与剖面线平行
零件序号要按顺序排列
序号排列要整齐

b) 误



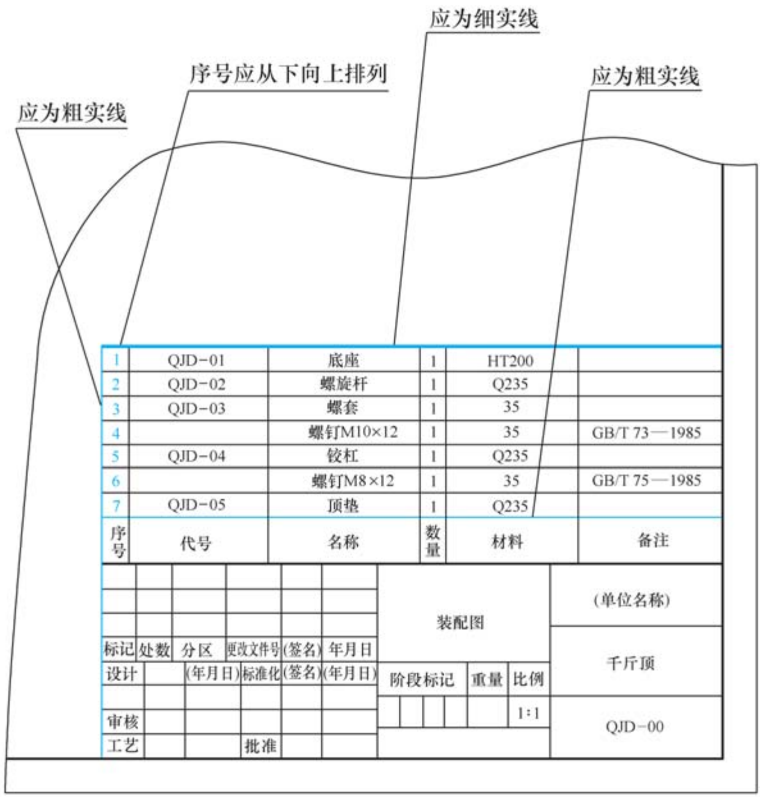
扫码看视频讲解

例 8-12　分析装配图明细栏序号排列的正误



a) 正

扫描看视频讲解



序号	代号	名称	数量	材料	备注
1	QJD-01	底座	1	HT200	
2	QJD-02	螺旋杆	1	Q235	
3	QJD-03	螺套	1	35	
4		螺钉M10×12	1	35	GB/T 73—1985
5	QJD-04	铰杠	1	Q235	
6		螺钉M8×12	1	35	GB/T 75—1985
7	QJD-05	顶垫	1	Q235	

b) 误

说明

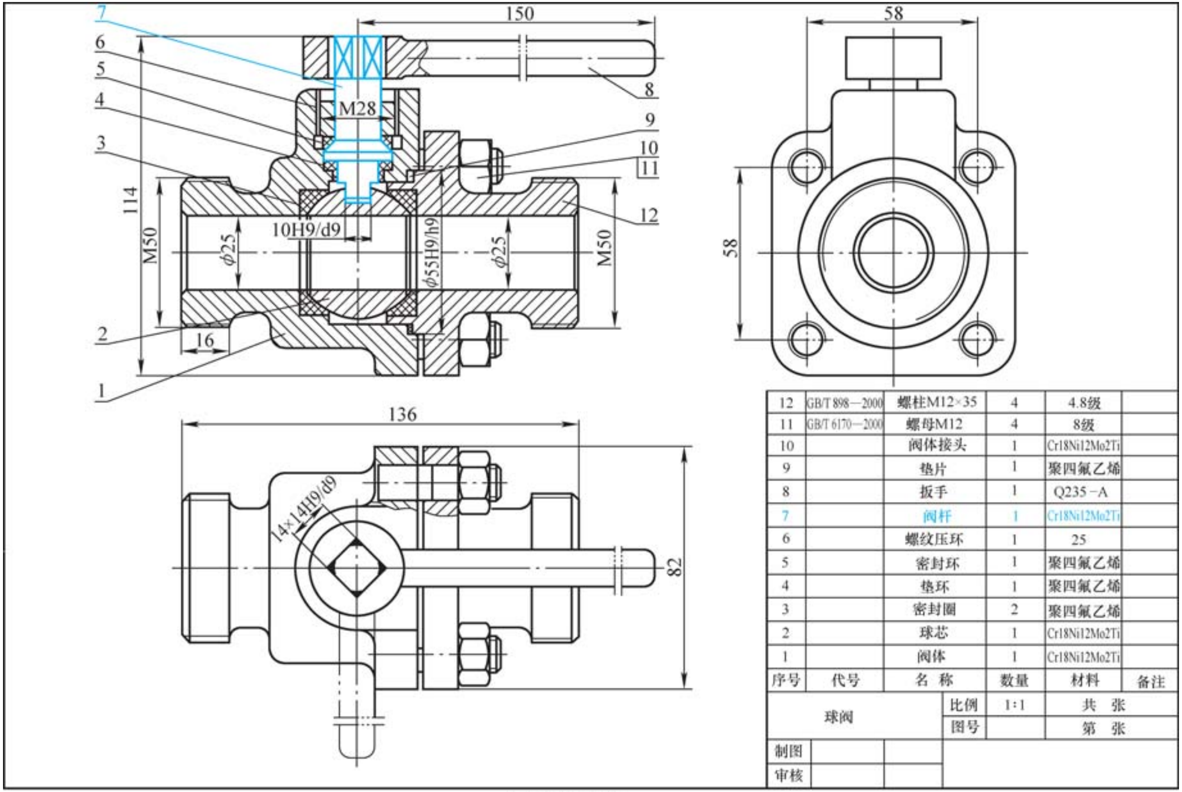
1. 零件明细栏的位置在标题栏的上方。

2. 明细栏的外框竖直线、明细栏与标题栏的分界线、明细栏表头与内容的分界线是粗实线，其余均为细实线。

3. 明细栏内零件的序号应从下向上顺次填写。

8.3　由装配图画零件图

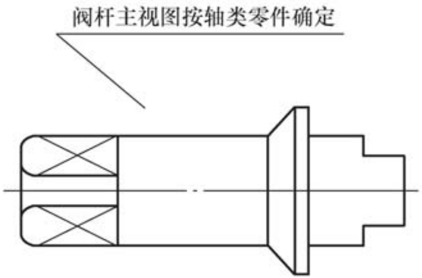
例 8-13　分析由球阀装配图拆画阀杆零件主视图的正误



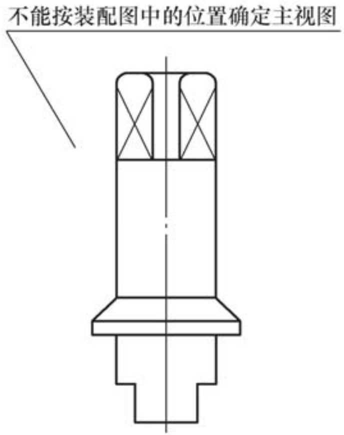
序号	代号	名称	数量	材料	备注
12	GB/T 898—2000	螺柱M12×35	4	4.8级	
11	GB/T 6170—2000	螺母M12	4	8级	
10		阀体接头	1	Cr18Ni12Mo2Ti	
9		垫片	1	聚四氟乙烯	
8		扳手	1	Q235-A	
7		阀杆	1	Cr18Ni12Mo2Ti	
6		螺纹压环	1	25	
5		密封环	1	聚四氟乙烯	
4		垫环	1	聚四氟乙烯	
3		密封圈	2	聚四氟乙烯	
2		球芯	1	Cr18Ni12Mo2Ti	
1		阀体	1	Cr18Ni12Mo2Ti	

球阀	比例	1∶1	共　张
	图号		第　张
制图			
审核			

a) 球阀装配图

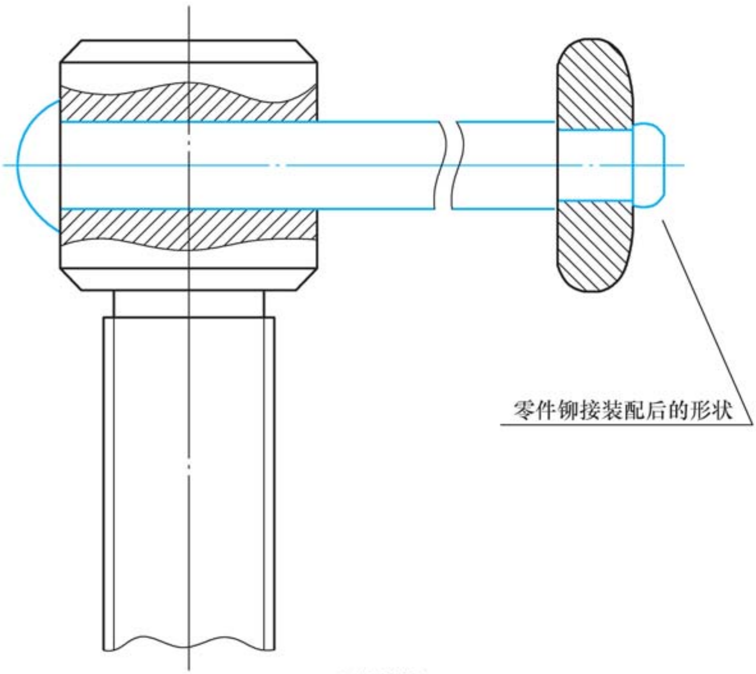


b) 正



c) 误

例 8-14　分析拆画铆接类零件视图的正误



a) 装配图



b) 正

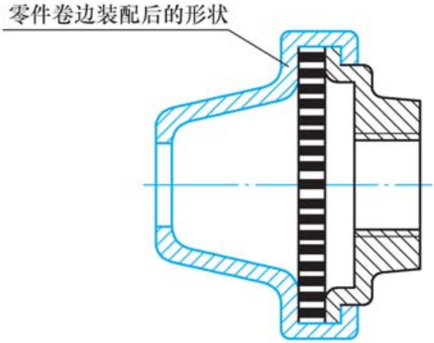


c) 误

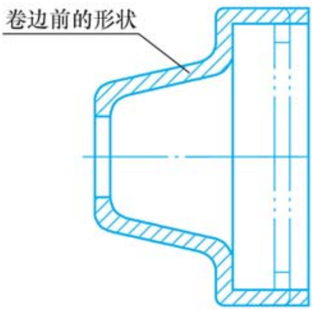
说明

在装配图中，零件采用铆接，零件的头部已经变形了，因此在拆画零件时要将变形部分按铆接前的形状画出。

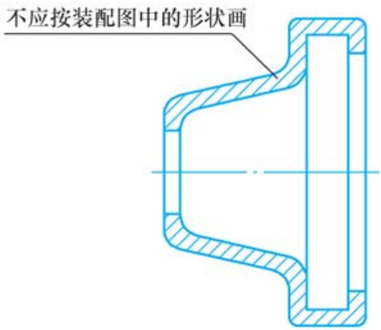
例 8-15　分析拆画卷边类零件视图的正误



a) 装配图

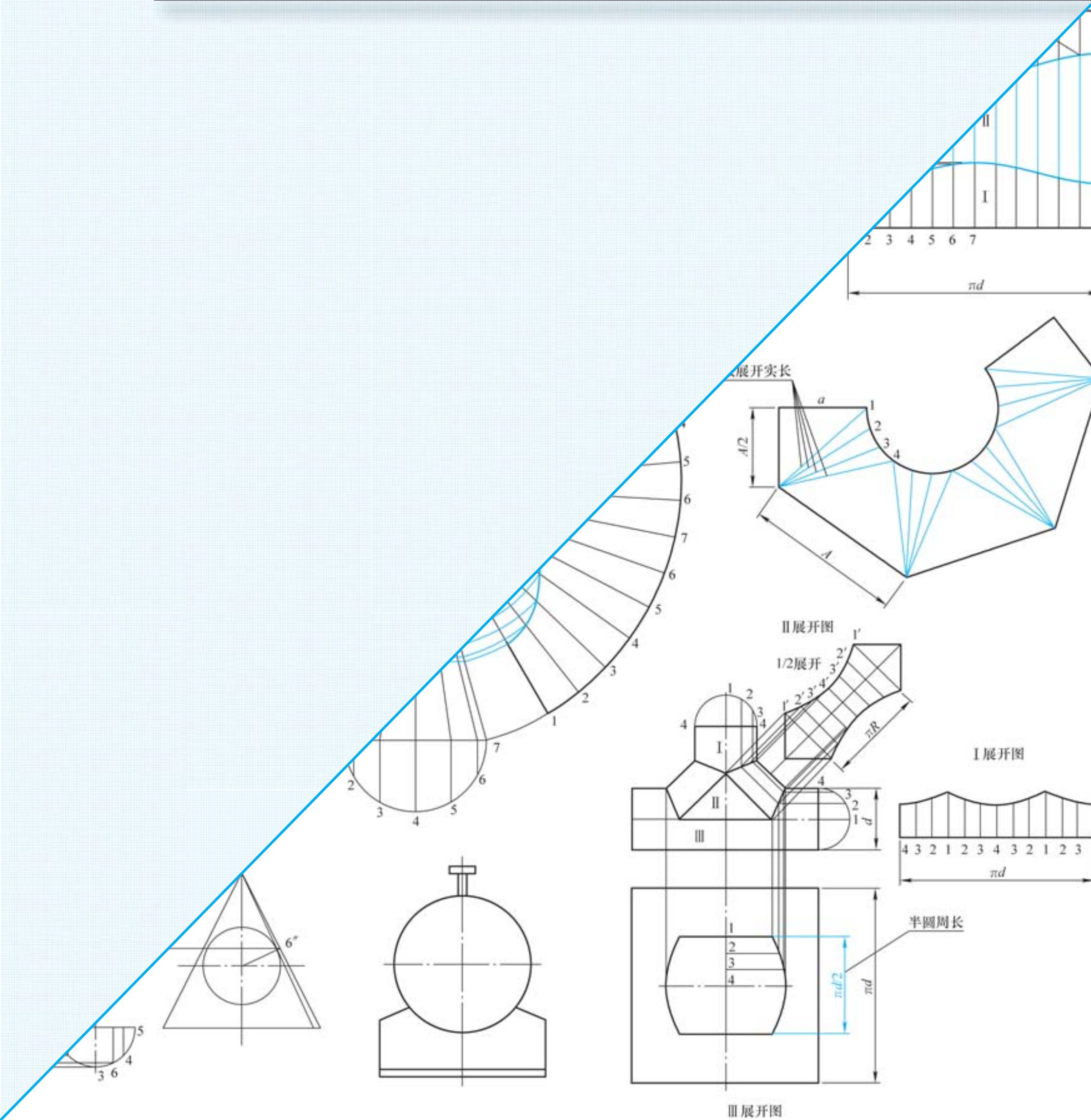


b) 正



c) 误

第 9 章 钣金展开图与焊接图

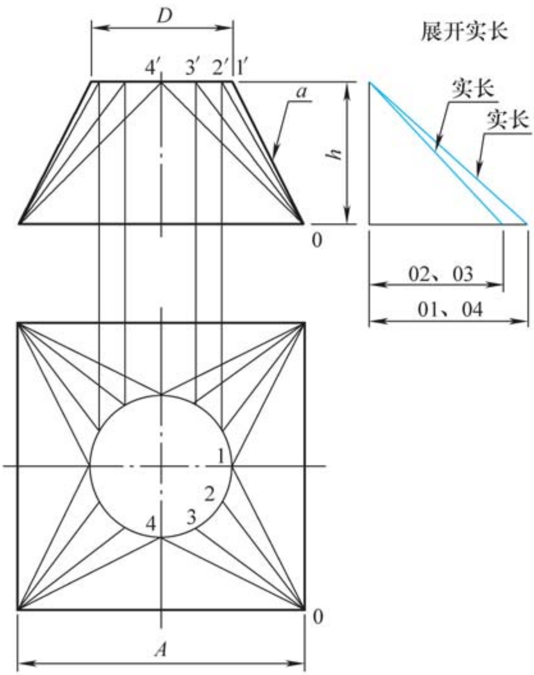


9.1 钣金展开图

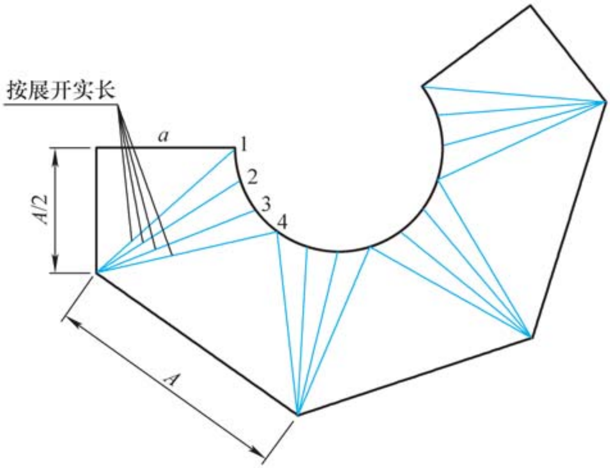
例 9-1 分析钣金展开图的正误



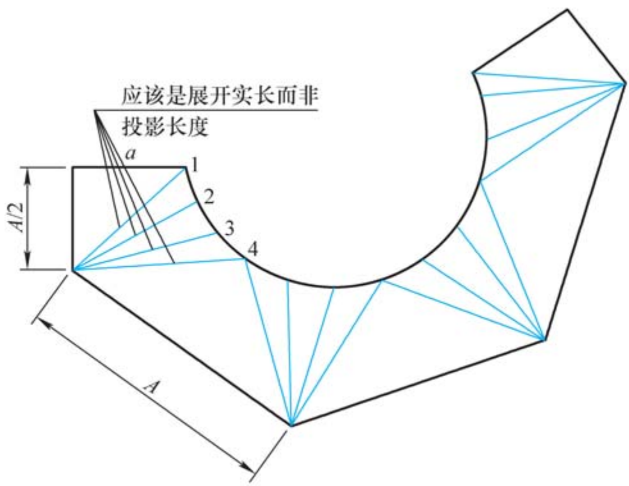
a) 立体图



b) 视图



c) 正

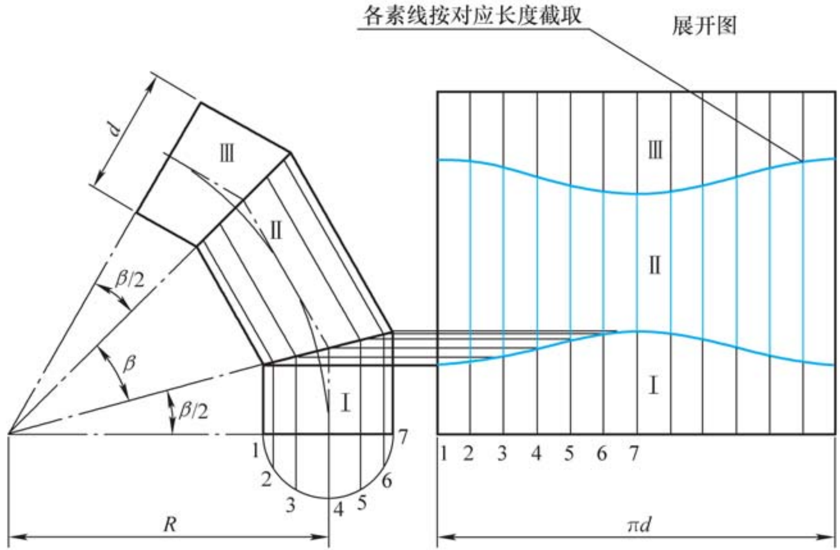


d) 误

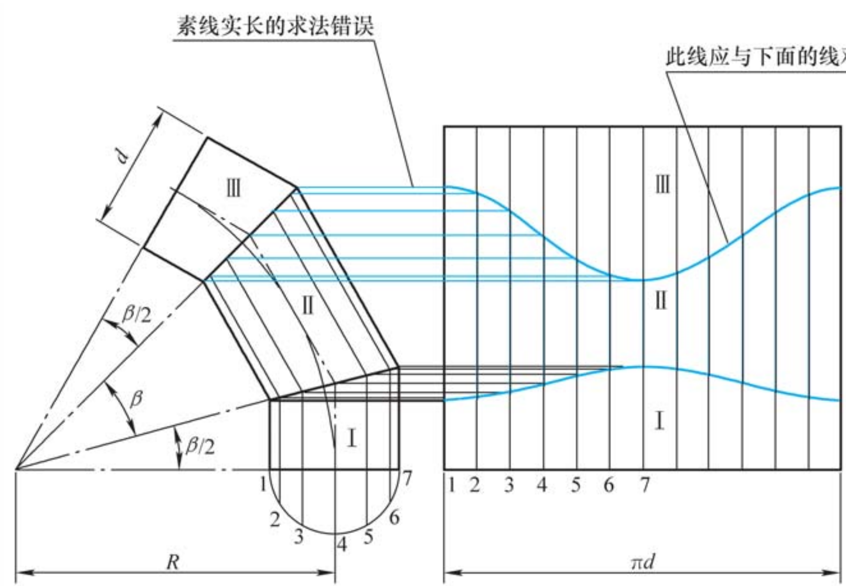
例 9-2　分析钣金展开图的正误



a) 立体图

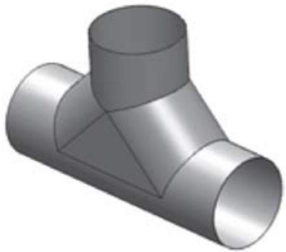


b) 正

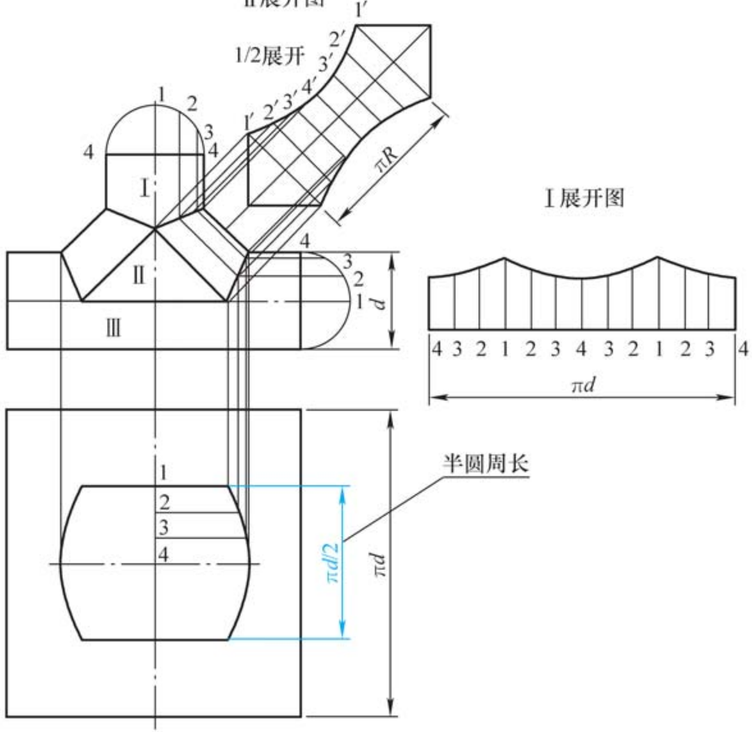


c) 误

例 9-3　分析钣金展开图的正误

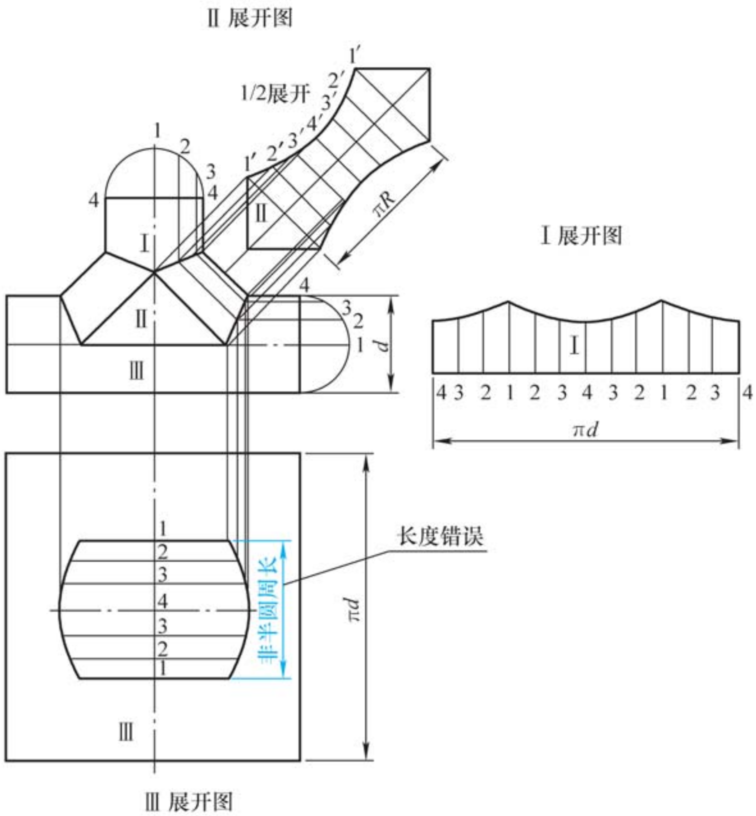


a) 立体图



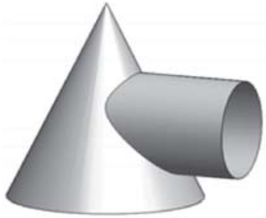
Ⅲ展开图

b) 正

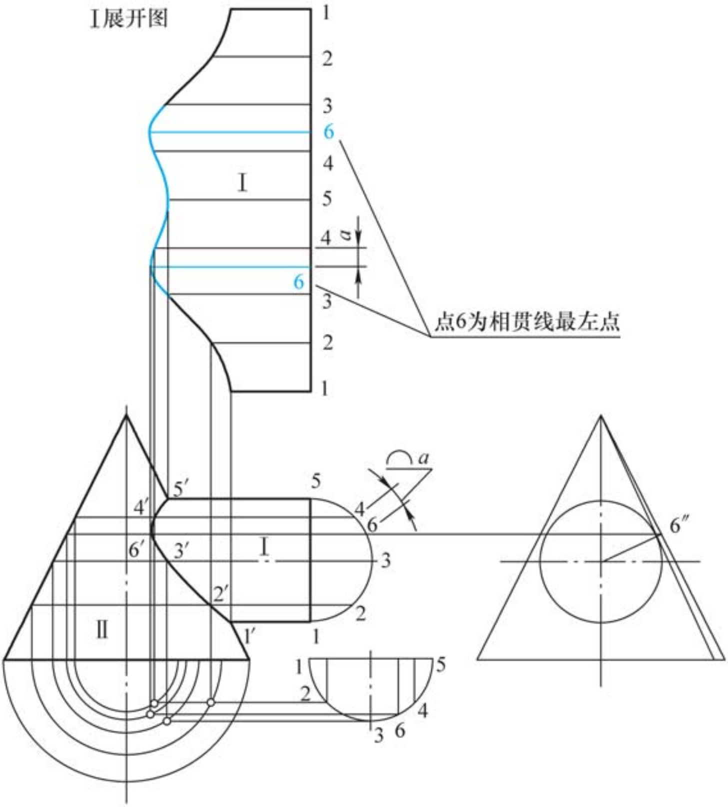


c) 误

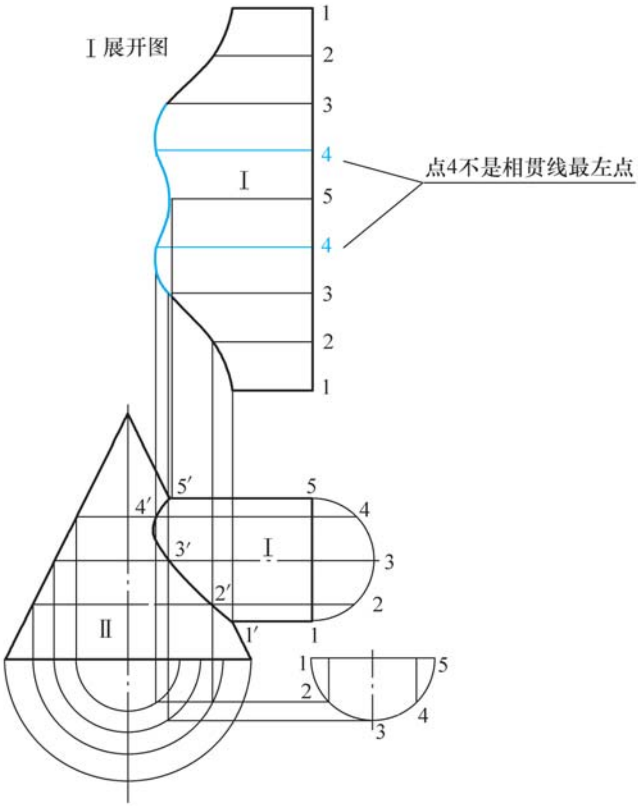
例 9-4　分析钣金展开图的正误



a) 立体图



b) 正

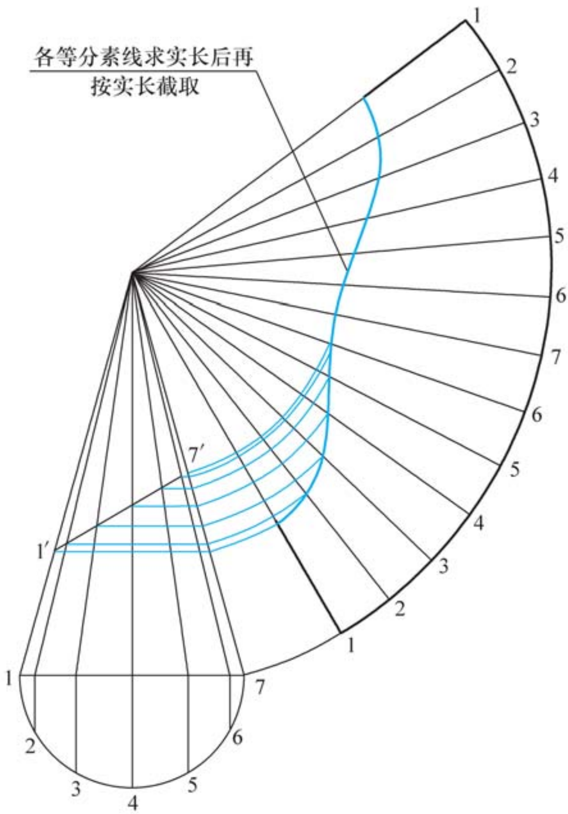


c) 误

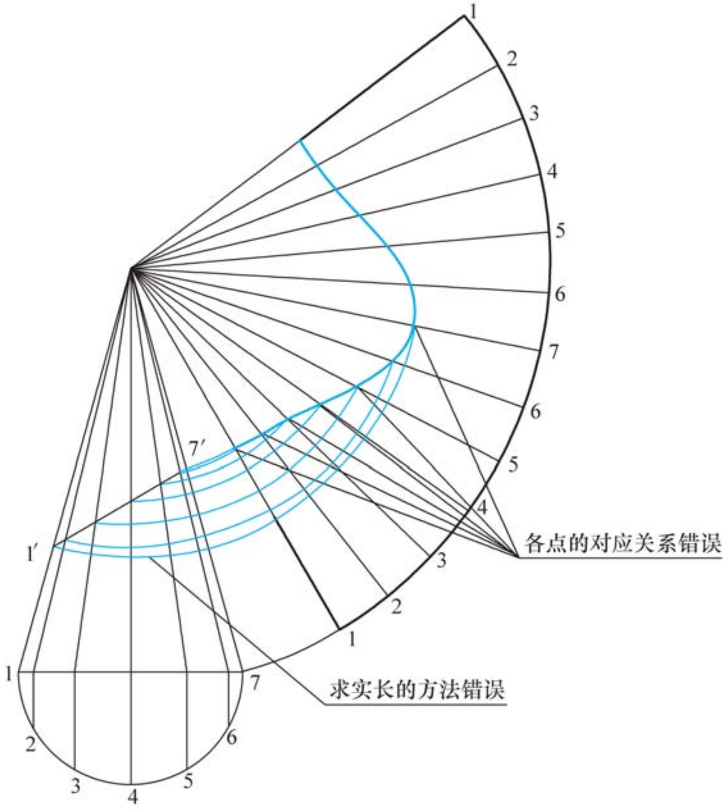
例 9-5　分析钣金展开图的正误



a) 立体图



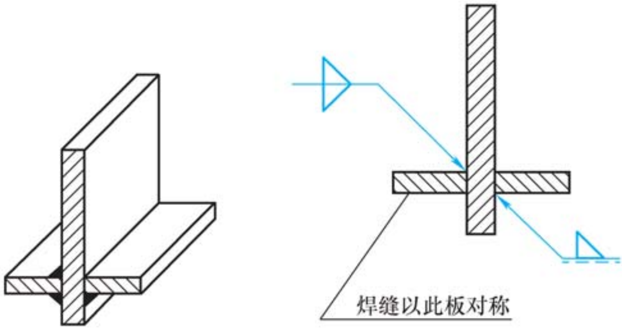
b) 正



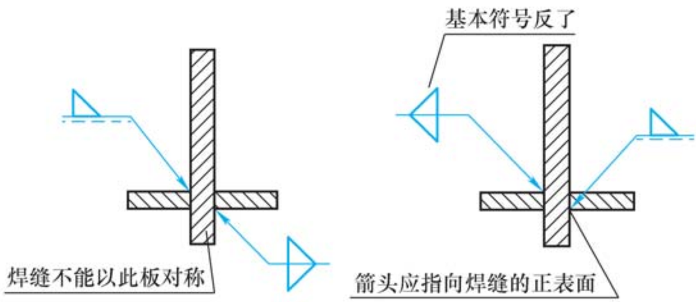
c) 误

9.2 焊接图

例 9-6　分析对称焊缝符号注法的正误

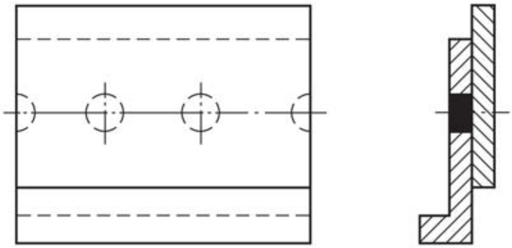


a) 立体图　　b) 正

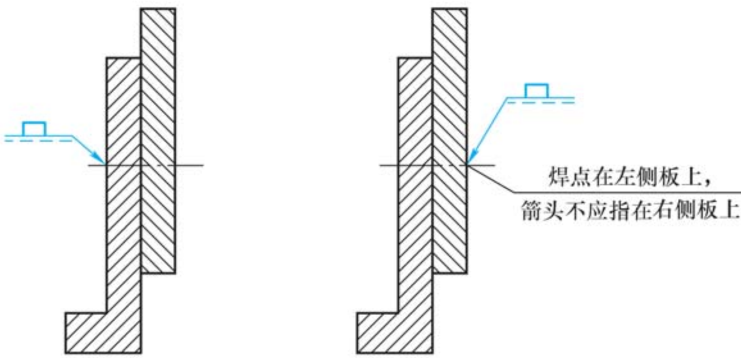


c) 误　　d) 误

例 9-7　分析焊缝符号注法的正误

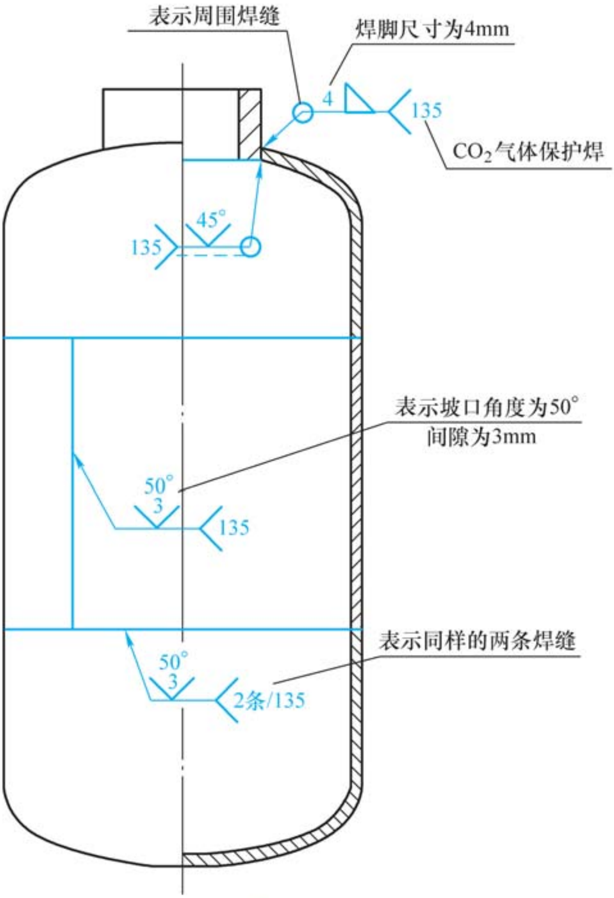


a) 视图

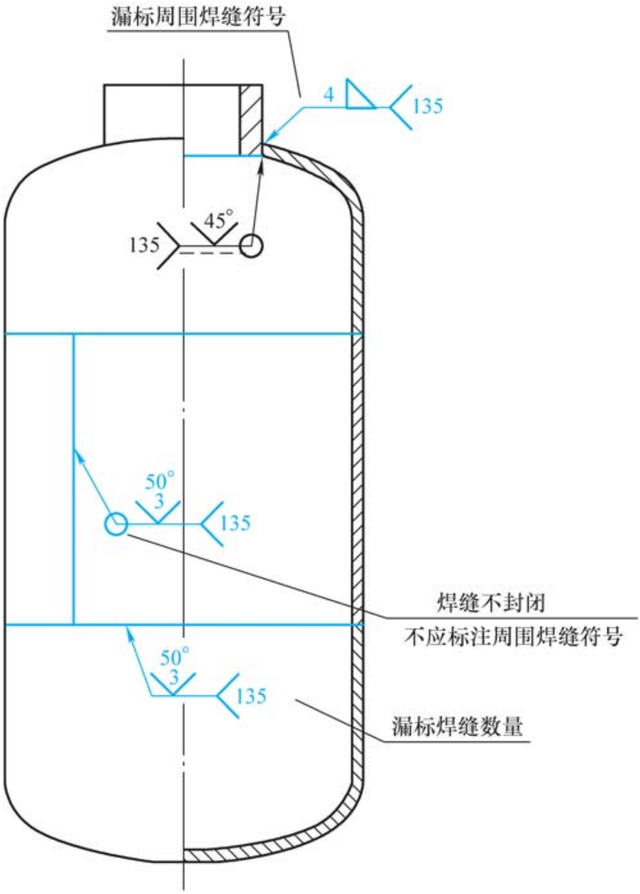


b) 正　　c) 误

例 9-8　分析液化石油气瓶结构图焊接注法的正误

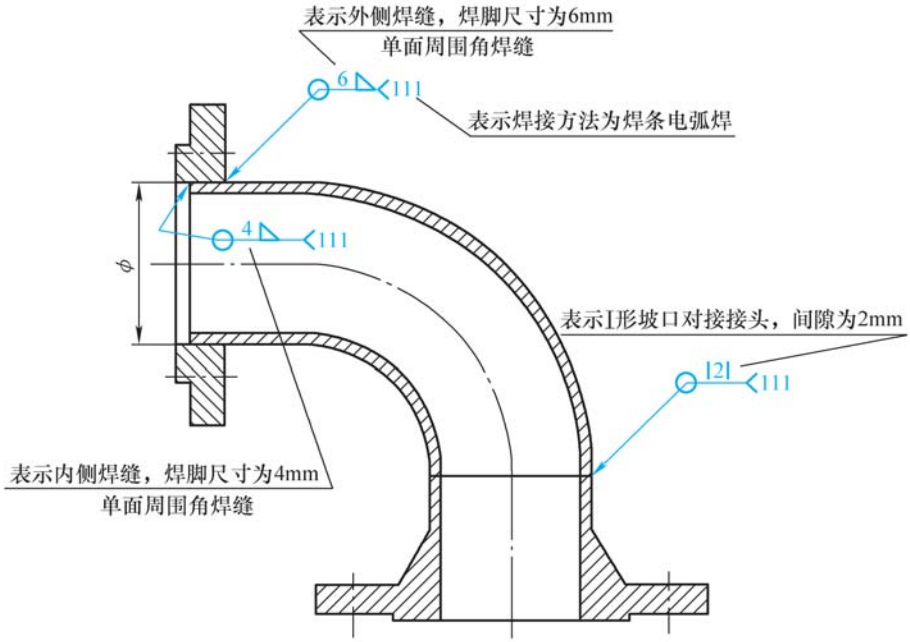


a) 正

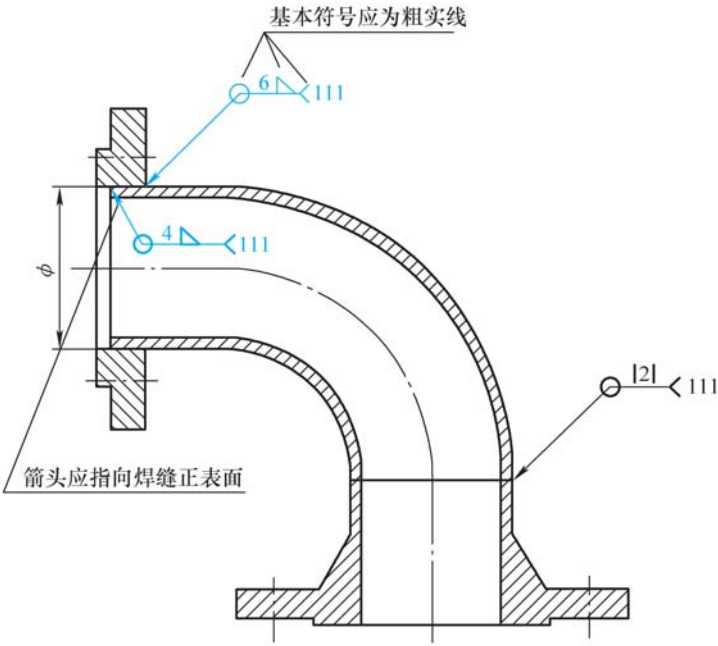

漏标周围焊缝符号
4
135
45°
135
50°
3
135
焊缝不封闭
不应标注周围焊缝符号
50°
3
135
漏标焊缝数量

b) 误

例 9-9　分析焊条电弧焊焊缝注法的正误

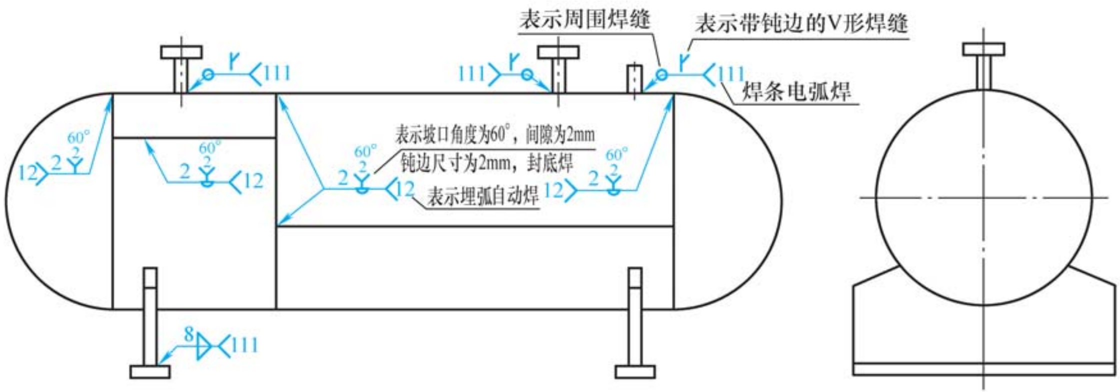


a) 正

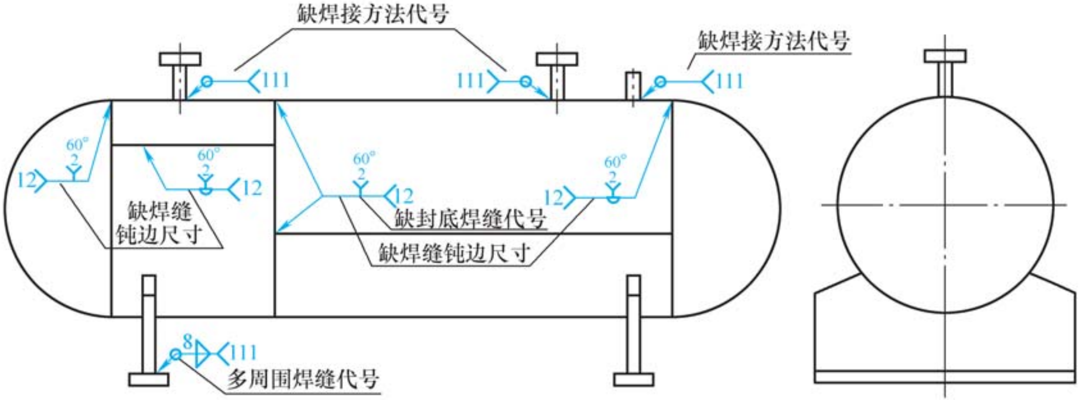


b) 误

例 9-10　分析埋弧自动焊焊缝注法的正误

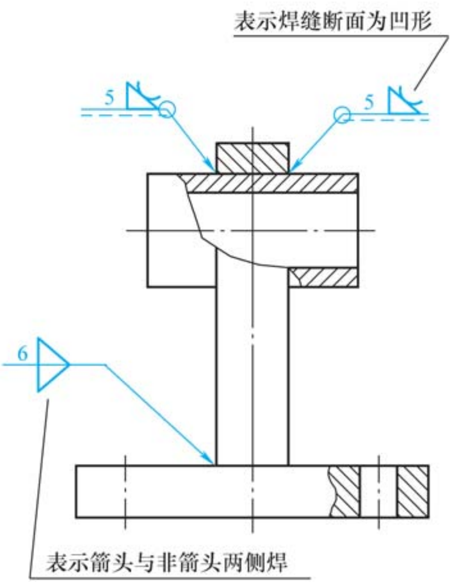


a) 正

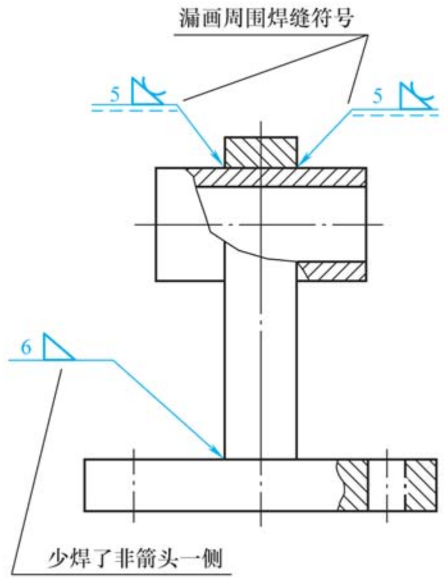

缺焊接方法代号
缺焊接方法代号
111
111
111
60°
2
12
60°
2
12
60°
2
12
60°
2
12
缺焊缝
钝边尺寸
缺封底焊缝代号
缺焊缝钝边尺寸
8
111
多周围焊缝代号

b) 误

例 9-11　分析支座焊接图焊缝注法的正误



a) 正



b) 误

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